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The Expert Judges

ANYONE who has attended the trial of a suit relating to patent details before judges of an ordinary court can not have failed to be impressed with the difficulties encountered by the judges in arriving at a decision concerning facts their whole knowledge of which must be acquired from the arguments and documents submitted by the opposing parties. The results of appeals from many such decisions justify the assumption that the judges are influenced more largely by the relative abilities of the lawyers presenting the two sides of the case than by the relative importance of the physical facts under discussion. As a step in the right direction toward overcoming the limitations of knowledge on the part of judges much interest attaches to the hearing conducted last week by the Bureau of Standards in Washington upon the joint request of the Underwriters' Laboratories and the Economy Fuse & Manufacturing Company to consider evidence bearing on the relative fire and accident hazards of standard approved fuses and the refillable fuses of the company which the Underwriters have not approved. It is self-evident that the method adopted in this case is far preferable to the usual procedure of appealing to courts with abundant authority but inadequate knowledge. It should produce excellent results in cases in which the parties to the controversy agree to abide by the decision rendered by the expert judges who act without authority or any interest in the controversy other than that of collecting the evidence and analyzing the facts in dispute.

Reduction of Going Value

IN a recent audit of the Manitoba governmental telephone system the interesting point was made that whereas the business carried a substantial going value at the time of its purchase from the Bell interests, based on a 7 per cent return on the appraised investment, such values have been dispelled by reason of unprofitable extensions into farming country since the acquisition of the system by the Government. In any public utility involving a comprehensive distribution system the policy with respect to extensions beyond the apparent commercial limit needs to be determined with great care. Some allowance properly can be made in growing communities for natural increase of business, but without applying the tenets of the best engineering judgment it is hazardous to attempt to build up a network of indefinite limits without some co-operation in the way of the user's caring for the "overhead," at least for a time. The exact cost of supplying service on a given extension can be determined only with approximate accuracy when prorating of general expenses enters the situation, and it certainly should enter into any scientific administration of a property. In a municipal or State-owned system the fixed charges and even part of the operating costs may come out of the public in the form of unappreciated taxation. It is a significant result of governmental methods of doing business to find an auditor setting forth such a shrinkage of going value as that above quoted.

Legislative Rate-making for Commissions

THE decision of the New York Public Service Commission, Second District, in the Ulster & Delaware Railroad case, which was mentioned in last week's issue, involves principles of vital importance to central stations. By a majority of three to two the commission holds that it lacks power to increase a rate above the maximum set by the Legislature. The division of the commissioners on a pure question of their authority under the law and the concern of all classes of utilities in the outcome make it especially desirable that the issue shall be settled by the highest court. If the commission may play with rates below an arbitrary boundary set by an uninformed Legislature but is without authority to cross the line in order to afford a fair return on a fair value in a particular case, it is shorn of its rightful jurisdiction. The question of where rate-making really belongs if it is to be undertaken by public authorities has been raised periodically since regulation began. Some Governors have protected commissions from rate-making raids of Legislatures. To do this, however, they face political opposition, and no matter with what recognized practice they rebuke the Legislatures, the issue raised is uneconomic and unnecessary. Since the Legislature is not equipped to make rates through investigation, study and valuation, its authority should be transferred with confidence to the commission. The present decision greatly strengthens the hands of those who are urging that the New York commissions be made constitutional offices and that the rate-making power of the Legislature be reduced or abolished.

A Topographical Map of Output

IN our Digest this week appears a very striking study of load distribution as shown by a new method of charting. The plan is in reality a very simple one, although the chart looks quite intricate. The hours of the day and the months of the year serve as the usual co-

ordinates in two dimensions. Contour lines like those on a topographical map represent the load, combined with such shading as may be necessary to make them distinct. The result is a species of relief map which indicates immediately at what hours and over what periods of the year loads of certain values are distributed. The simple chart given in the Digest shows, for example, mountains of load piled up at about 6 o'clock in the evenings from October to January, a range of hills representing the morning load, and a conspicuous though somewhat irregular valley at noon all through the year. Most striking is the effect of the war, terminating the foothills of the ordinary peaks by a precipitous fall at about the beginning of August, 1914. When carefully studied the shape of the contour affords a vast amount of information concerning the variations of load from hour to hour and from week to week, and a peculiar interest attaches to the variations in the electrical load topography from year to year. For example, as between the great peaks of 1913 and 1914 the former fell earlier than the latter, was far less extensive, and did not reach so much beyond 6 p. m. Between the dates noted additional load had evidently been assumed which spread the peak and carried it further into the edge of the evening, besides raising it very materially. The morning peak, too, in the same months, was increased and carried over somewhat later in the year. A contour map of this kind can be studied with profit for a long time. It affords a particularly useful method of ascertaining at a glance the varying load characteristics of a station during the successive periods of its operation.

Transmission Tower Construction

The article by Mr. A. D. Cudebec on transmission lines contains a very large amount of useful information, not regarding the simple details of line and tower design, but with respect to the extremely important matter of setting up the line once the material is at hand. Most tower lines for transmission work have been built by construction gangs organized under the direct management of the owners of the line. A few have been built under contract at a fixed price and occasionally some on the cost-plus-percentage basis. Mr. Cudebec strongly favors the construction of the line by the owners on the ground that the changing methods and designs, the necessary alterations which may take place during construction, and the difficulties connected with right-of-way combine to make it difficult for a responsible contractor to bid a lump sum for the work. As to the cost-plus-percentage gain, if the contract is a large one, the owners might as well get the benefit of the percentage as turn it over to an outsider, to say nothing of the possible advantages in purchasing material arising from the natural thriftiness of a company that is trying to save its own money at every point. However this may be, Mr. Cudebec shows that the materials usually amount to from 70 per cent to 80 per cent of the whole cost of the tower line, so that the necessity for close buying to reduce costs is imperative. In the matter of labor a long line has great advantage over a short one of precisely the same construction in the better organization and more comprehensive experience of the working gangs.

The successive processes in erecting a pole line may be summarized as follows: Staking out the locations, getting and clearing the right-of-way, placing the tower footings, assembling the towers, erecting them and stringing the wires, followed by a general clean-up. The first two operations can be done at almost any time but the remainder must follow each other in orderly sequence. The transportation of the towers for assembly is oftentimes a very serious task and the footings may involve a great expense in both labor and transportation, particularly if they are of concrete. In any case the work should be so timed as to have the towers assembled on the ground, ready for erection, as soon as the excavations of earth are ready or the foundations, if of concrete, have had time to set. A little foresight in determining where the various kinds of footing are to be provided, having the tower material at hand on time, considerably facilitates the erection of a line. In general practice the towers are assembled lying flat on the ground and then raised into position by tackle and shear legs. It is astonishing how easily a large tower can thus be put into place when the tackle is properly rigged, and the tower itself brought to just the right point before attempting to lift it into place. It is impossible to put too much care into the inspection and securing of the tackle, as a break may mean disastrous accident, to say nothing of wrecking the tower, which, while amply strong against the strain it is intended to withstand, cannot be thrown around with impunity.

Ordinarily the stringing of the wire follows rather quickly upon the placing of the towers, which are usually erected with the insulator strings already in place. One of the points which recent experience has brought to the front in the stringing of wires is that a good deal of damage can be done to conductors by jamming them with metal snatch blocks. An injury thus inflicted to the surface of a hard-drawn copper conductor makes a material difference in its strength, and many breaks have occurred at points of the wire damaged during the erection. Ordinarily the alignment of the wires and the adjustment of the sag can be accomplished well enough by sighting, but in erecting some important lines, especially those made of aluminum cable, it has been found desirable to put the wires under regular tension by a dynamometer grip. One good point mentioned by Mr. Cudebec is the desirability of starting in on any easy point in the line for construction work, in order to give practice to the construction gangs before they encounter the really difficult parts of their work.

The whole article is full of valuable suggestions for those who are engaged in the work of erecting tower lines. While much of it applies chiefly to somewhat heavy construction and the building of long lines, there is a great amount of detail which would prove service-

able to the more frequent case of relatively short and light lines on which it is desirable to use steel construction and suspension insulators.

Immediate Preparedness

It is a matter of pride and satisfaction to all good citizens to learn that Mr. Thomas A. Edison has consented to become the head of the naval advisory board for the bureau of invention and development. Moreover, Mr. Edison will probably exert no small influence in the organization of the bureau on practical lines that will insure adequate results. The country owes a debt of gratitude to the veteran inventor for his co-operation at this time, when war has developed acute need for technical work in meeting new and startling conditions. The terrible struggle now going on is unique in that it combines the ferocity of medieval warfare with the last refinements in implements and methods of destruction. However one may regret the necessity it is perfectly obvious that in any future war it must be a case of fighting fire with fire and meeting each new terror with a response even more destructive. Under sea, and in the air, with shells, machine guns and deadly gases the United States cannot afford to be behind Europe on pain of mortal peril at no distant date. Under present conditions of "civilization" the nation that neglects to meet every destructive possibility of warfare promptly and efficiently will assuredly pay the penalty of negligence. Hence it is that the proposed board will have enormous scope of action and will be compelled to deal with an infinite variety of subjects. It will have to help in passing upon thousands of inventions, good, bad and indifferent, in directing experiments toward wise selection from these, or the development of others, and not impossibly may have to take a hand itself in the solution of some very pressing problems.

Under-sea warfare will perhaps constitute the most imperative necessity. However its activities may be restricted by agreement the submarine has come to stay; it will increase in radius of action and offensive power, and become an important part of every war fleet. The bureau of invention and development will probably face at the very outset the task of devising means sufficiently potent to discourage any trans-Atlantic foe from attempting to harass our coast. The aeroplane, strictly an American invention, has fallen intc disuse until it is negligible from a military and naval standpoint. Between the submarine and the aeroplane the bureau will encounter serious work from the very start.

Minor problems without number are awaiting solution, such as the improvement of powders for both small arms and great ordnance so as to obtain greater velocity with less chamber pressure; the discovery of a jacket for bullets which will not smear and fill the rifle with closely adherent metal, and improved equipment for trenches on land, and for the detection of mines at sea. Add to these all the variety of smaller things that make for efficiency in equipment both for offense and defense and one has a list of demands upon any technical body which calls for the greatest energy and highest degree of skill. It is well that the work is being undertaken now rather than at some later date. It is especially fortunate that the call to preparedness has come at a time when Mr. Edison's vast abilities and long experience can be turned to the service of the country.

Dielectric Losses and the Cathode Tube

The cathode-ray tube which, a few years ago, was but a scientific toy, has been converted into a measuring instrument in the hands of high-tension electrical engineers. In 1911, Prof. Harris J. Ryan showed how the Braun tube could be utilized to give a photographic record, after the fashion of a polar oscillograph, from which the effects of electric corona could be deduced. The cathode-ray oscillograph has the advantage over the ordinary vibrator oscillograph, that it is virtually devoid of inertia; so that frequencies of millions of cycles per second are capable of being photographed with its aid without any appreciable error. The ordinary vibrator oscillograph is subject to correction for inertia at frequencies not exceeding a few thousand cycles per second, and ceases to operate at frequencies that are within the limit of audibility. On the other hand, the vibrator oscillograph has the advantage of revealing the wave-form of voltage or current in rectangular co-ordinates; whereas the cathode-ray oscillograph presents it in polar co-ordinates, a form that has usually to be translated into rectangular co-ordinates, in order to be easily understood.

A paper on the use of the cathode-ray oscillograph, or "cyclograph," for the study of dielectric admittance at high tensions, was read by Mr. John P. Minton at the recent Deer Park convention of the A. I. E. E. The voltage impressed on the tested sample of dielectric, the penetrating current strength, and the phase angle between them were measured and recorded in a very interesting way. The results obtained with various commercial forms of dielectric show that, as is generally surmised, the effects of temperature and the effects on power loss of moisture in the sample are very large. It would seem that when an insulating sample is in good dielectric condition its admittance is substantially constant over a wide range of impressed electric voltage intensity. This means, of course, that the penetrating current varies directly with the impressed voltage, while the power expended in the sample varies as the square of the impressed voltage. When, however, the effects of increasing temperature within the sample begin to reveal themselves, the admittance, current, and power, depart from the above-mentioned simple relations. The author shows that the power-factor may vary over wide limits, that the current may rise much faster than the impressed voltage, and that the power consumed may vary with the voltage in a complicated manner. The method of investigation described in the paper calls for a specialized technique, and for many precautions, but it promises very well for further development.

LETTERS TO THE EDITOR

Depreciation Accounts

To the Editor of the ELECTRICAL WORLD:

SIR:—Your issue of June 26 contains an article on "Depreciation Accounts," by Willard H. Lawton, from which I quote: "The difference between the balance of this [depreciation reserve] account and the total of the plant cost account indicates the present net (depreciated) value of the plant."

I think that the author will agree with me that he is not correct in that statement. It is a statement, however, that is met frequently and commonly believed to be perfectly true.

Mr. Lawton correctly states: "The periodical depreciation charge is seldom based on actual ascertained depreciation, but on some theory which assumes that the unit depreciated will have to be replaced at a certain date more than one year in the future."

What is the result if the "theory" is wrong? Even though the "theory" be right in principle, but the assumed prospective life be wrong, what becomes of the proposition that plant account less depreciation reserve account equals present value of plant? Evidently the proposition does not state the fact in either case.

A depreciation reserve annuity consists largely of an insurance premium, the insurance being against probable functional depreciation due to obsolescence and inadequacy. A fire insurance reserve might be provided in similar manner. Yet it is evident that a fire insurance reserve should not be deducted from the cost of a building to get its net value consequent upon a fire that has not yet occurred. A depreciation reserve account has no necessary relation to the actual accrued depreciation as disclosed by an appraisal.

New York, N. Y. HALBERT P. GILLETTE.

Interchangeable High-Tension Switches

To the Editor of the ELECTRICAL WORLD:

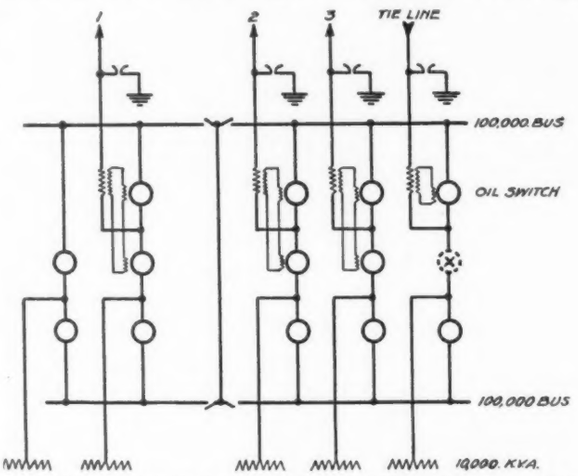
SIR:—In designing the high-tension busbars for a 50,000-hp. generating station use has been made of the scheme indicated by the inclosed sketch. The writer would be pleased to hear from some of the readers of the ELECTRICAL WORLD if the scheme is in existence or if it has ever been tried.

As will be observed, there is only one bus, equipped with four disconnecting switches, kept closed under normal operation, which are to be opened only when it is desired to separate the bus or to cut out sections, for repair, cleaning and inspection purposes. There are five 10,000-kva. transformers, each associated with two oil switches by which it can be cut in on the bus or on a separate line. The upper row of oil switches serves as the line switches, the lower row are transformer switches, while the center row of switches serves both the line and the transformers. There are four high-tension transmission lines, the fourth being a tie line, connecting with another generating station. Each of the lines 1, 2 and 3 is equipped with one series transformer, its secondaries connected in series with the trip coils of two oil switches with definite time overload relays. The lower set of oil switches (or transformer switches) is not equipped with series transformers. Due to the flexibility of the bus, various methods of switching can be employed. Any oil switch out of a set of three can be cut out for repair, cleaning, etc., without losing either a transformer or a line; in fact should two be cut out, one could still continue to use either the bus or the line, depending, of course, upon which second switch is out of commission.

When a short-circuit takes place on No. 2 line the two oil switches (should they both be closed at the time) open and the line clears itself without disturbing the rest of the system. When it is desired to transmit 20,000 kw. over No. 1 line and to separate it from the system, use is made of No. 1 and No. 2 transformers, one or two disconnecting switches are opened, three or all oil switches are closed and the line is thereby isolated from the system.

Tie line No. 4, which is equipped with a reversed-power relay, is used to "feed into" the bus; it can be used to "feed out" by merely changing the setting on its relay, and if an oil switch is installed at "X" it can "feed out" and be isolated from the system if need be. When one or more lines are separated at the same time they are still held in synchronism on their low-tension bus, which is arranged along the same lines.

The above scheme can be adopted for various purposes, any kind of switching can be done, without losing



INTERCHANGEABLE LINE AND TRANSFORMER SWITCHES

the service of any unit, but its chief advantage resides in the fact that no matter what trouble may take place, it is quickly isolated without disturbing the rest of the system. Regardless of what switches should be out of commission at the same time, one can still continue to deliver the energy from the station.

Renton, Wash. C. OPITZ.

Uniform Electric Rates Based on Costs

To the Editor of the ELECTRICAL WORLD:

SIR:—The letter of Mr. Henry B. Jackson on uniform electric rates based on costs in your issue dated July 10, is very interesting, particularly as he shows signs at the end of the letter that in time he will agree with the opponents of such rates.

There is no objection to the use of any short cut or formula provided the final object of service to the public is kept in view. Adjusting rates so that the *total* of all the rates is equal to the cost plus a fair profit tends toward serving the public to the best advantage. Adjusting class rates among themselves so that *each* rate fits some particular method of computing the cost may happen to give good rates; but when such rates are not as low as others giving a fair return, they injure the public, even if based on a cost formula.

If the rates are first calculated by some cost formula, and when this gives unsatisfactory results are then expediently adjusted so as to get the business and serve the public, no particular harm is done. The danger comes when the cost formula rather than service to the public is taken as the *basis*. When a rate maker begins to see that cost is not the basis of individual or class rates, and to see that service to the public at the lowest possible rates that will allow a fair profit on the whole investment is the real basis, he is on the right track. If it could be realized by all that rates based on a cost formula are never lower than rates based on the value of the service, and are usually much higher, a great step would be taken toward electricity for everybody.

Taking up now Mr. Jackson's letter in detail, he asks where the figure of $6 for meter expenses was obtained. It is given on the authority of Mr. P. R. Moses of "Isolated Plant" fame. Mr. Jackson's reference to a $9 minimum charge is not clear. In Mr. Moses' suggested uniform rates based on costs he does not appear to suggest any minimum; but even if he did, how does it affect the question? Supposing it costs only $2 to maintain the meter, but the customer uses only 1 kw.-hr.

Mr. Jackson understands that meter expense includes all expenses except those involved in delivering the energy, and then computes a cost of $600 a kilowatt as being absurd. But a customer with a 10-watt lamp, who requires a service costing say $100, a meter costing from $5 to $10, and also meter readers, accountants, postage, etc., must involve a very high cost per unit, no matter what assumptions are made.

Mr. Jackson, I fear, beclouds the question, which is not as to whether any particular rate is fair or a particular cost reasonable, but whether uniform rates based on costs will be as low as rates based on service to as many classes and customers as possible.

The Third Avenue-New York Edison case is very illuminating, and Mr. Jackson's questions show just why public service corporations are chary about some services they could render to the public. As I said before, I am not familiar with the exact contract made, and only refer to the kind of contract which easily could have been made—and very likely was made.

If the New York Edison Company had *bought* the Third Avenue plant for any specified sum, there would have been muckrakers to complain that the price was both so high and so low as to be bad for everybody.

Instead, the agreement could have been, and apparently was, that *whatever* was a fair price for the use of the plant should be charged, and as the Third Avenue owns the plant the exact figure would make no difference. Say it had been costing the Third Avenue company 1 cent per kw.-hr., of which ½ cent was for operating, and ½ cent for fixed charges, depreciation, profit, etc., on the money invested in the plant. The New York Edison Company takes over the plant at a price so that ½ cent just pays these fixed charges, etc. Very likely it would be simpler for the New York Edison Company merely to *hire* the plant at a rental just sufficient to pay these charges, and then to bill them back to the Third Avenue as part of the charge for energy.

So long as no change was made in the physical work neither the Third Avenue company nor the Edison company would lose or gain, and, of course, no physical change would be made except a decrease in expenses.

Next, it is found that a physical connection would allow a reduction of costs, as by shutting one plant down at light loads, even if there were no diversity-factor that would reduce the total peak.

This connection will not be made until it will result in a net saving. When the saving has been made all the customers, both the old customers and the new one, which is the Third Avenue company, are being served off the same wires. What price shall be charged to the Third Avenue company when it is merely one of the customers that are being served off the Edison system? The total of all the costs is less than before, and hence the total of all the rates is to be reduced, but how? Must all the Edison costs be averaged? In fact are there *any* costs that *must* be averaged over the class of customers that includes the Third Avenue company?

Of course the Third Avenue company will not object so long as it gets its share of the saving, but suppose that the computation by which the costs are assigned to the different classes brings the price to the Third Avenue company above what it would cost this company if it took back its plant and ran it independently? Will not the Third Avenue company take back its plant, and thereby destroy the saving by combination, and necessitate charging higher rates to the rest of the public, unless the Edison company keeps the rate down to what it would cost the Third Avenue company by itself? And if any cost formula or any averaging of the Edison costs involves charging the Third Avenue company so much as to force it back on its own plant, will not this be an injury to the public? It will destroy the saving that would otherwise have been made, and thereby require either the other Edison customers or the Third Avenue company to pay more than would have been sufficient to produce a fair return on both properties if they had been combined.

It is sometimes difficult to see that an average is nothing but an average, and is not the real cost of each individual part. The essential points are these.

First: Combination or co-operation need never be more expensive than independent operation, and is usually much cheaper.

Second: In order to have combination or co-operation each party must get some of the advantage, and no one should suffer; that is, he should not pay more than he would have paid if operating separately.

Of course, if combination is not advantageous, if New York City could be more cheaply served by a small plant in each block, then the New York Edison Company has made a great mistake in changing its old generating stations into sub-stations; but if one big plant is more economical than numerous small ones, then the rates should be made so that this economy can be gained, even if it results in the wholesale customer, such as the Third Avenue company or the large buildings, getting a lower rate than the small user. This fact applies generally, though the New York Edison-Third Avenue company contract brings it out especially clearly.

Uniform rates, whether based on cost or on anything else, will result in higher costs and higher rates to the general public than rates chosen on the basis of using the plant and investment so as to give the maximum amount of service. The small user would much rather pay 10 cents per kw.-hr. and see the Third Avenue company served for less than 1 cent and large building customers for 5 cents, than to pay 12 cents himself and see the Third Avenue company and the large buildings make their own energy for 1 cent and 6 cents respectively. Of course, if the large user should get the energy for any substantial amount less than he could make it for himself, or if the electric companies are making a mistake in building a few large plants rather than numerous small ones, the present rates would be unjust; but unless the wholesale users are getting their energy substantially below what it would cost them in their own plant, and unless the central-station engineers have made a serious mistake in building the large stations, the small user is receiving service much more economically than would be true under the uniform electric rates.

Lynn, Mass. WILLIAM ADAMS.

CONTROVERSY OVER REFILLABLE FUSES

Bureau of Standards Holds Hearings to Determine Whether or Not the Use of Refillable Fuses Introduces Extra Fire Hazard

At a public hearing on refillable fuses called by the National Bureau of Standards, Washington, D. C., July 8, two sessions were held, one in the forenoon and the other in the afternoon. Dr. S. W. Stratton, director of the Bureau of Standards, acted as chairman of the former session, and Dr. E. B. Rosa, chief physicist of the bureau, as chairman of the latter.

In opening the hearing Dr. Stratton outlined the development of the activities of the bureau, beginning with the investigation of standards of measurements, the preparation of specifications for materials, first for government service and later for use by the public. He stated that the hearing on refillable fuses represented an important event in the history of the bureau, which for the first time was acting as arbitrator to avoid the expense of unnecessary legal tangles. Upon the joint request of the Underwriters' Laboratories and the Economy Fuse & Manufacturing Company, the bureau undertook to bring together for discussion all available facts having a bearing on the following question:

"Has it been shown that the use of the fuses manufactured by the Economy Fuse & Manufacturing Company results in no greater fire or accident hazard than the use of other cartridge fuses at present listed as standard by the Underwriters' Laboratories?"

Dr. Rosa explained that members of the bureau's staff had tested many fuses in order to ascertain the behavior under all practical service conditions, had consulted with wiring inspectors of numerous municipalities, had visited many installations to make a thorough investigation of refillable and non-refillable fuses. He stated that a full digest of all the evidence considered at the hearing will be made public at some time in the future.

Among those who participated in the discussion were Messrs. W. H. Merrill for the Underwriters' Laboratories, Chicago, R. L. Foot, A. L. Eustice and H. E. Clifford for the Economy Fuse & Manufacturing Company, Chicago, H. R. Sargent for the General Electric Company, Schenectady, N. Y., Guy Cunningham and L. W. Downes for the D. & W. Fuse Company, Providence, R. I.

Mr. Merrill expressed his appreciation of the value of co-operation between the Bureau and the Underwriters' Laboratories for which arrangements were made two years ago. He said that the staff of the Bureau is well qualified and in excellent position to decide between citizens in conflict over technical matters.

Mr. Foot stated that more than 1,000,000 refillable fuses have been sold by the Economy company and sufficient evidence has been accumulated to determine whether or not these fuses in service represent a greater hazard than do the fuses approved by the Underwriters' Laboratories. He claimed that, on account of the extra cost involved in returning an approved cartridge fuse to the manufacturer for refilling, the temptation to refill the fuse on the premises is very great. As a matter of fact, 40 per cent of the users of standard approved fuses admit refilling on their premises. In the case of the Economy refillable fuse the cost involved in refilling the fuse properly is so slight that there is no temptation to refill improperly.

Mr. Foot read fourteen affidavits from wiring inspectors and persons similarly qualified to ascertain the magnitude of the fire hazards produced by fuses, in Chicago, Cincinnati, Indianapolis, Covington, Cleveland, Milwaukee, Philadelphia, St. Louis and Columbus, in order to show that the hazard with the Economy fuse has proved to be at least no greater than that with standard approved cartridge fuses. In practically every case the inspectors stated that the Economy fuses had been properly refilled, while standard fuses had been abused.

Mr. Merrill claimed that the affidavits should not be taken too seriously because they related to experience with several types of Economy fuses. The earlier types were much superior to the latest type which alone was under discussion before the Underwriters. He remarked that the opinion of the staff of the Bureau of Standards cannot be different from that of the staff of the Underwriters' Laboratories.

Mr. Cunningham claimed that the manufacturer should always be held responsible for the operation of a fuse. He cannot be so held when the user is permitted to refill a fuse that has blown in service.

Mr. Sargent remarked that users who attempt to reload standard non-refillable fuses, in spite of instructions to the contrary, will improperly refill all other types of fuses. He said that the cost of the fuse service actually required will be less with the standard fuses reloaded by the manufacturer than with refillable fuses reloaded by the user.

Professor Clifford outlined the results of tests made upon fuses at the Market Street substation of the Commonwealth Edison Company, Chicago, which indicated that in no sense were the Economy fuses inferior to standard fuses and that in some respects they were superior thereto.

Mr. Downes claimed that the number of standard fuses improperly refilled is relatively very small, being perhaps 4000 per year out of 6,000,000 produced annually. In reply to a question by Mr. Foot, Mr. Downes stated that standard fuses refilled by the manufacturers are tested at the factory but not at the Underwriters' Laboratories.

Dr. Rosa mentioned the fact that standard fuses are reloaded in various localities by companies not associated with the manufacturers.

Mr. Foot claimed that the Underwriters are inconsistent in demanding extra long practical service of refillable fuses before approval while approving certain non-refillable fuses that have been in service for a very short time.

In bringing the hearing to a close, Dr. Rosa requested that all available information relating to the subject under discussion be submitted to the Bureau of Standards. The staff of the Bureau will investigate all evidence submitted before rendering its decision.

Mayor Signs Cincinnati Rate Ordinance

The proposed permanent electric-rate ordinance for the city of Cincinnati, recently adopted by the local City Council on the recommendation of the light committee of that body, has been signed by Mayor Spiegel, and will take effect unless the talk of a referendum petition develops into action. In stating his reasons for signing the ordinance, which has been objected to strenuously by both the Union Gas & Electric Company and citizens' organizations, the Mayor pointed out that while the maximum rate provided by it is only 8.5 cents per kilowatt-hour, the former ordinance had a maximum rate of 11 cents per kilowatt-hour, and that temporary ordinances since in force provided for a maximum of 10 cents per kilowatt-hour. Mr. Spiegel also declared that few cities have lower rates, except where water power is available, and that the reduction in the company's revenues which will be made by the new ordinance will amount to $205,000, unless there is a large increase in the use of energy.

Steel-Tower Transmission-Line Construction

Organization of Line Staff, Delivery of Material, Preparation of Footings, Assembling of Towers, and Other Data

BY A. B. CUDEBEC

DURING the past ten years rapid changes and improvements have been made in the design and construction of high-voltage transmission lines. Even a cursory study of engineering files covering a decade past will repay the reader who is interested in learning the details of improvements which have been wrought. A few lines of steel towers, chiefly of the light windmill type supporting single circuits, were

FIG. 1—STRUCTURAL-STEEL TEMPLATE FOR SETTING TOWER FOOTINGS

operating in 1904. All of these were of the pin or rigid-support type.

The advance in ten years is shown by the compiled transmission-line data in the ELECTRICAL WORLD issue of April 25, 1914, in which was published a list of fifty-four lines which were then operating at 70,000 volts or higher. Of this number only four were of wooden construction. The aggregate length of these fifty-four lines is 5910 miles, and most of them are equipped with suspension-type insulators.

Tower lines are either single-circuit or double-circuit, the supporting towers for the former averaging about 45 ft. in height while those for the latter are usually between 75 ft. and 80 ft. high. As yet no distinct type of tower has demonstrated a marked superiority over its competitors and new shapes are constantly being designed. This is especially true of cross-arms as well as of the method of attaching insulators to conductors and towers.

Very few, if any, of the steel-tower transmission lines of the United States have been built by contract in the strict interpretation of the term. Some of the lines have been built either upon the basis of cost plus a fixed percentage or for a stated fee, but the larger portion of them have been built by force account. The reason for using force account may be attributed to one of several things:

(1) The methods and designs upon transmission-tower lines are changing rapidly, and responsible contractors may hesitate to bid a lump sum upon work with which they are not as yet familiar.

(2) Owing to many natural obstacles which may come up during construction, changes in the original location of towers, special structures, etc., are frequent. Changes are always a source of argument with the contractor, and such matters frequently have to be settled in court.

(3) Few, if any, transmission lines have been started after all of the right-of-way has been secured, and, of course, this lack of right-of-way would give the contractor an ample excuse for complaint.

Factors Influencing Cost

Although the cost of a heavy tower line may vary from $4,000 to $12,000 per mile, yet it is of interest to note that the materials of construction alone aggregate between 70 per cent and 80 per cent of the entire cost. However, the remaining item of labor is of importance, as it reacts directly upon the time element, which is usually a vital factor in the general development scheme.

Possibly the chief obstacle encountered in building up an experienced transmission-line crew is the intermittent character of the work. It is the exception rather than the rule for a superintendent to be able to transfer a well-organized and smooth-running tower-line organization from one job to another without a delay long enough to cause the organization to scatter beyond repair. A superintendent is fortunate if he can gather even a few experienced men to form a nucleus around which he can build the field organization. The progress reports of most tower-line jobs show a steady increase in efficiency until the work is nearly complete.

Organization

It is difficult to outline a clear-cut transmission-line organization which would work efficiently upon any transmission job. Each individual line must be studied to determine what size of organization will work out to best advantage. For instance, labor is cheap in the South and very high in the far West. The amount of laborers in proportion to linemen, etc., may depend upon the wages demanded by each, all other things being equal. The longer lines have an advantage in unit costs

FIG. 2—FOOTING MEMBER FOR STEEL TOWER

due to the increasing efficiency as the construction continues and smaller proportionate overhead expense, the process being similar regardless of the length of line.

The supervising staff upon a fair-sized job is made up as follows: (1) Superintendent, (2) assistant superintendent or general foreman, (3) cashier or chief accountant, (4) chief material man, (5) commissary manager, (6) cost engineer.

Superintendent

The superintendent obviously is the one dominant head upon whose experience, judgment, force, tact and general executive ability depends the success of the construction plans, both as regards cost and time.

Some superintendents spend large portions of their time in the field directing general operations, while others delegate to the general foreman or assistant superintendent, as the case may be, the carrying out of plans and maintaining speed. The latter method seems much preferable, as the securing of material, supplies and labor can be controlled best from the office. A close watch upon progress can be maintained by daily reports, amplified with frequent conferences with the general foreman together with the aid of visits to the field every few days.

General Foreman

Unless the transmission line is unusually heavy, the general foreman acts in the capacity of an assistant superintendent and has authority to engage and discharge men who report directly to him. The requirements which go to make up an excellent transmission-line general foreman are severe. He should be selected and sent upon the ground as far in advance of actual construction work as possible. Two or three weeks can be spent to good advantage in going over the whole construction area. He should carefully consider and select camp locations and note all highways available for distribution of material along the lines. He should also decide what streams, deep gulleys and other natural obstacles should be bridged and where all fences should be cut, and should acquaint himself with the sources of supplies for men and teams.

All of the field operations are directly under the general foreman, and previous experience on transmission-line work is essential to his success. Although equipped with experience in other classes of work, this experience might be of little value upon this new class of construction. In addition, he should be well equipped with a knowledge of general construction methods and organization. The widespread pole-line work in connection with telegraph and telephone companies has developed a large number of line foremen who are accustomed to handling small crews but who are not trained to plan organization methods upon a large scale. Necessarily these men have received very modest salaries. Good transmission foremen are, however, still scarce, as the field as yet has been too limited to train many men who have the natural capacity to develop into general foremen. It will prove to be economical in the long run to engage the best general foreman available and pay him a good salary.

Unless the spirit of team work has been unusually well developed, each gang foreman will endeavor to make the best possible showing for himself and crew, regardless of the difficulties which he may be placing in the way of the next crew behind. For example: An assembly crew might find that one piece of a cross-arm was so badly bent that it could not be used, or it might be missing. Instead of notifying the general foreman or material man to supply the needed part and following this up by detailing some of his crew to replace it on its arrival, the gang foreman might complete the assembly of the tower, leaving the cross-arm imperfect. This defect might go unnoticed until the arrival of the wire-stringing crew. Its discovery at this time would mean a serious delay to a large crew. Either a halt would have to be made until these missing parts were supplied or a stretch of wire would have to be left without sagging. The whole crew would then have to go back when the cross-arm was ready to support the conductor. This is only one of many incidents of a similar nature pertaining to missing or broken insulator disks, shortage of bolts, etc., which frequently happen. Improper placing of towers upon the ground during assembly sometimes causes excessive erection charges.

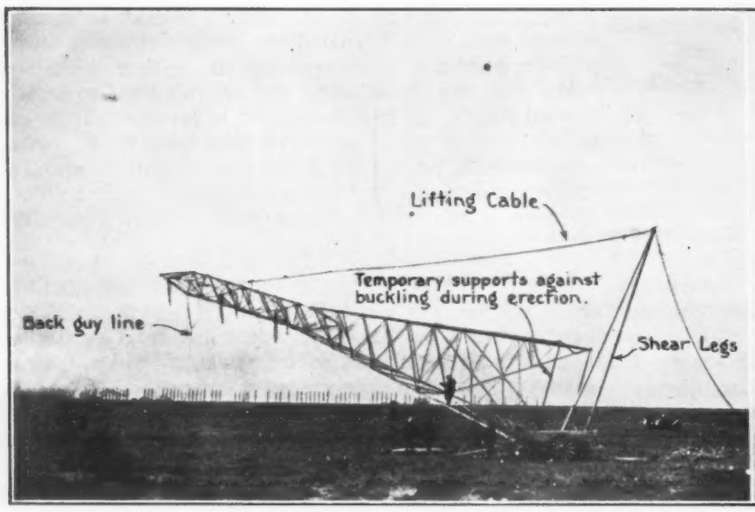


FIG. 3—DETAILS OF TOWER JUST AFTER ERECTION HAD BEGUN

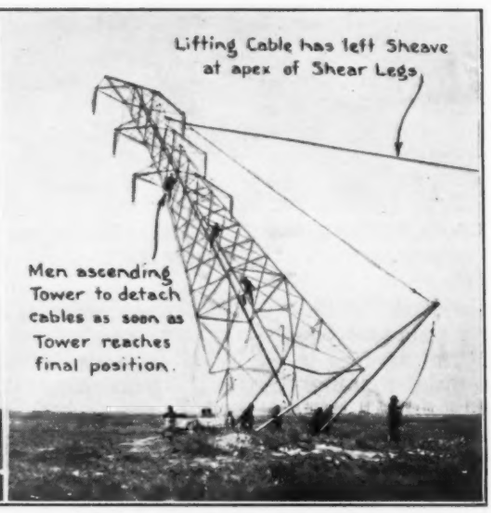

Lifting Cable has left Sheave at apex of Shear Legs
Men ascending Tower to detach cables as soon as Tower reaches final position.

FIG. 4—TOWER NEARING VERTICAL POSITION

The general foreman should be familiar with all of these processes, and he must keep close enough to each gang foreman to minimize selfishness and encourage team work.

Cashier

The duties and qualifications of the chief accountant are not unlike those required upon other classes of construction. Although many of the detail reports must be forwarded from the outlying camps, all bills for material are paid through the main office under his charge except for petty purchases. All timekeepers and accountants report to the cashier as far as matters of payroll and material payments are concerned, although the timekeepers for each gang of men also report to their immediate foreman.

General Material Man

As has been often stated, the prompt and correct delivery of material over a long line is of prime importance, and the man in charge of material delivery must be equipped with previous warehouse experience,

together with a natural ability for organization. A good working knowledge of railroad operating difficulties, storage facilities, demurrage regulations, and a capacity for meeting any emergency, are all essential in carrying out his plans. He should be able to devise a careful system of forwarding and receiving and should at all times know where extra parts for each kind of tower, insulator, etc., can be secured with the least delay. Such men are scarce, and their salary should be commensurate with the responsibility involved.

Commissariat

It is the universal practice among transmission construction concerns to employ their men upon a fixed salary and board. In order that the efficiency of the construction organization be maintained, it is almost necessary for a large portion of the laboring force to stick steadily to the job. Good board appeals to a laborer as next in importance to the salary he receives. It is, however, difficult to maintain good board in temporary portable camps, and the head commissary has no sinecure. Each camp usually has its own cook, but most cooks are not capable of buying or accounting for supplies. This duty falls upon the gang foreman or the timekeeper, who reports his needs to the general commissary.

Cost Engineer

Only a decade ago the position of cost engineer upon any construction work was almost unknown. Such cost records as were kept were made up by the regular accounting force, but upon most jobs to-day we find a trained cost engineer. He constantly maintains a close check upon all expenditures and is able to estimate running costs closely to within a few days of the time of computation. Each cost engineer usually has his own method of arriving at results, but the essential point is the ability to place before the superintendent the unit-cost records which are being made by each individual crew. The inefficient crews then receive more attention, or, if necessary, the foreman is changed.

Importance of Material Delivery

Possibly no part of the construction campaign requires more careful planning than in providing for a correct and economical delivery of material, which must begin before the excavation for footings is under way and must be continued well in advance of the assembly and wire-stringing crews.

The problems presented in material delivery upon transmission construction are unique and have few parallels. Many superintendents who are entirely successful in handling heavy concentrated work do not readily appreciate the difference in planning deliveries scattered along, say, a hundred-mile stretch of territory.

Once organized and under way each crew performs a series of acts which are constantly repeated until that part of the plan is complete. Usually the next step cannot be undertaken until the preceding part is done. This means that failure in the delivery of material, such as footings, tower members, insulators, hardware or conductor, may actually delay the whole process together with postponing the ultimate time of completion. Upon heavy work, such as dams, power houses, railroads or municipal structures, the results of a failure in delivering of material may often be wholly or partially negatived by turning the crews over to some other part of the work which will, in any event, be necessary.

Sequence of Operations

The sequence of operations may be briefly outlined under the following headings: (1) Staking out tower locations; (2) clearing right-of-way; (3) excavating and placing tower footings; (4) assembling towers; (5) erecting towers; (6) stringing conductors; (7) clean-up.

Clearing Right-of-Way

In many portions of the country, especially in the South and Southeast, the item of clearing and maintaining a cleared right-of-way is quite important. This part of the construction scheme readily lends itself to sub-contractors, and in almost any part of the country men can be found who will take this clearing by the acre, or sometimes by the mile. Right-of-way men do not seem to have any general rule as to the trade which they make regarding the cutting and removal of timber, but in any event the stumps should be cut rather low and all logs and brush should be removed for a width of at least 25 ft. under each conductor in order that there may be ample room to assemble and erect towers and later to string the conductors. Patrolling the line after going into commercial operation is also facilitated by a well cleared right-of-way.

Tower Footings

The cost of construction may also be strongly influenced by the type of footing, concrete footings being much more expensive. Very little advantage is gained in starting the excavation for tower footings much in advance of the arrival of the footing material upon the ground as there is usually a strong tendency for the holes to cave in except where the ground is very firm and free from water. Even then it is a frequent occurrence for excavated material to slide back into the hole and have to be cleaned out before setting the footings. Trouble often occurs from live stock getting into holes left open.

There are two general methods in common use for setting footings, each scheme being best adapted to certain conditions. The two schemes may be briefly outlined as follows:

After making the excavation for the tower footing, the bottom of each hole is carefully leveled and kept open until the tower is erected. The tower legs are suspended just over the holes and the footing is bolted on while being held upright. The tower is then lined up and the holes are backfilled by a crew which accompanies the erection crew.

The alternate method is to excavate for the footing, set it to line and grade, and then backfill at once. The correct line and grade is secured by means of a wooden or structural steel template which exactly reproduces the positions of the several tower legs when in position (see Fig. 1). The towers are raised with their legs close to the footing and are readily bolted into place.

The first method can be carried out successfully with towers of moderate weight, say not over 4000 lb., provided that the soil is free from water. If, on the other hand, towers are heavy or the foundations are poor, it is better to set each footing member carefully and backfill it well in advance of the erection crew in order that a good settlement of the filling may be secured.

There seems to be a growing tendency toward the use of concrete foundations upon all transmission towers, and it follows that whenever concrete is specified all footings must be placed by use of a template far enough in advance of the erection crew so that no damage will occur to the concrete.

Special rock footings are sometimes furnished which are composed of bent structural members intended to be concreted into a moderate-sized hole which has been blasted in the rock. These footings are of a special kind and require particular attention in getting them delivered at the right point along the line. It is also necessary to guard against blowing these openings too large, which would result in a waste of concrete. It is likely that special rock footings do not reduce the ulti-

mate cost of footing as it is not much more expensive to blow a hole large enough to take the regular footings, which can be backfilled with loose rock and earth.

Material which is excavated for the tower footings should be deposited in such a manner as to cause a minimum of interference with the subsequent placing of construction material and assembly of towers.

Whenever the footings for towers are concreted over several miles of line, portable concrete mixers driven by gas engines are economical. Hand mixing and placing should be used only where the towers are either situated in inaccessible places or scattered at irregular points along the line.

Tower Assembly

The general practice at the present time is to assemble all towers complete, lying flat upon the ground, except over very rough ground where erecting tackle cannot be used to advantage. At such points they are assembled piece by piece in their final position. An assembly crew consists of six or eight men, always of even number so that each man may have a partner to assist him in holding the various members in place.

A small crew of men should precede the regular assembly gang to open the various bundles of steel, sort out and arrange them, and see that there is no shortage of steel or bolts. The base of the towers should be placed as near the projecting footing stubs as possible. This will save the erecting crew the time and expense of skidding the tower into position, which not only costs money but is likely to bend the lighter members.

Towers should be assembled parallel to the direction of the line in order to facilitate erection. If the nature of the ground compels assembly crosswise to the line, it then becomes necessary to omit assembly of cross-arms on one side in order to use modern erecting tackle. The added cost of assembling these cross-arms after the tower is erected is out of all proportion to the remainder of the assembly expense.

A crew of eight men will average from two to four towers per day, according to the nature of the ground. If the ground is very uneven at the point of assembly, the towers are blocked up to avoid undue strain upon certain members which might twist the tower out of shape. Any deformation in a tower frame will immensely reduce its working strength.

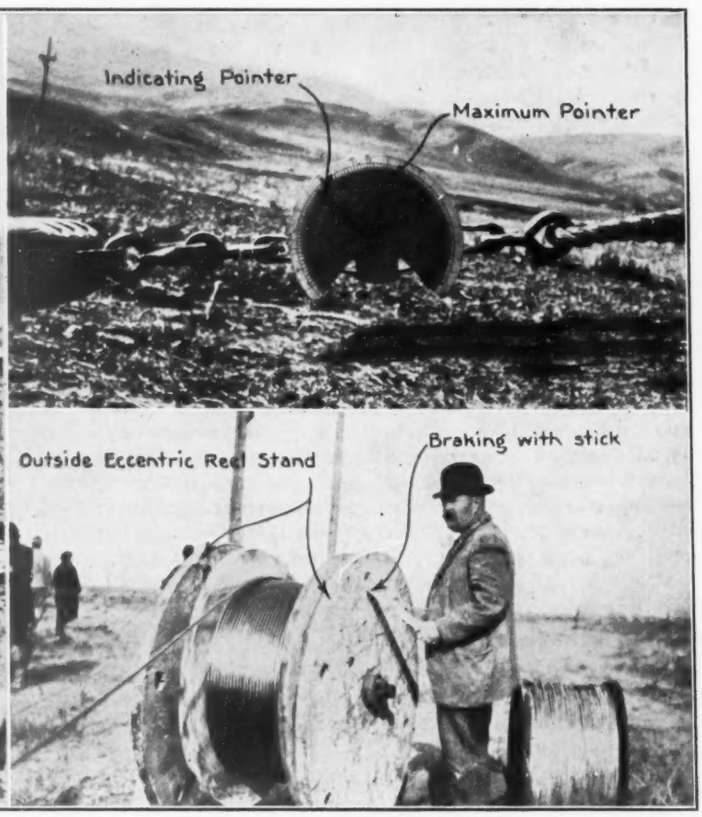
Erection Details

Towers are now erected by means of triple blocks and a specially devised A-frame apparatus. Some construction superintendents prefer using the double-A-frame scheme, i. e., lifting the towers by means of placing an A-frame on either side and swinging the tower into position between them. This scheme, however, is being displaced by the single-A-frame scheme as shown in Figs. 3 and 4. More accidents with resulting damage to towers occur during the erecting process than from any other cause. Carelessness in the smallest detail often causes a tower to drop before arriving in a vertical position. Two things are absolutely essential in the erection plan if speed is to be maintained and accidents avoided:

First—All of the blocks and tackle must have a high factor of safety and must be kept in excellent condition in order to be sure that when the strain upon this tackle is at a maximum there is ample safety.

Second—The ground pins must be very thoroughly driven down. Not less than three ground pins must be driven to anchor the main lifting tackle, and if the ground is at all soft or springy one or more additional pins should be driven. Each pin should be carefully tied back to the pin behind it. The scheme of driving and anchoring these pins successfully is copied from the methods used in securing large circus tents.

FIG. 5—DETAILS OF EQUIPMENT USED IN THE ERECTION OF TOWERS



FIGS. 6 AND 7—DETAILS OF DYNAMOMETER IN FIELD USE, AND DEMOUNTABLE ECCENTRIC REEL FOR PULLING CONDUCTORS

It is surprising to note how easily a tower can be dropped after it has been raised to a position about 45 deg. from vertical, thus every detail must be absolutely right before the tower starts skyward if accidents are to be avoided. The anchorage for snubbing the back guy line is also very important, and the man designated to pay out this line should be very careful and observing. Many towers have been dropped to the ground by being pulled too far over with the lifting line because the back guy line was improperly paid out or poorly anchored.

The organization of an erecting crew is capable of being very highly perfected. As many as seventeen heavy towers have been erected by one crew in a day, and it is not infrequent for well-organized crews to average from twelve to fifteen per day.

Many different schemes have been devised for providing a satisfactory fulcrum at the base of the tower upon which the tower legs may turn while being lifted to a vertical position. Some of the lighter towers have been successfully raised by simply providing "footing blocks," which have heavy bolts run through the blocks, the heads of which stick up about 2 in. The legs of the tower rest against these projections and are prevented from slipping, but heavier towers will soon break these blocks. One successful method consists of a shoe composed of structural-steel angles which fits over the tower leg and is bolted through the regular rivet holes. The lower edge of this shoe is provided with a loop of steel, the hole being about 5 in. in diameter. A piece of 4-in. black iron pipe is shoved through these loops from one leg to the other and provides a good axle. This pipe is held in place by steel cables which are anchored back with ground pins. (See Fig. 5.) As the tower begins to rise it turns on this pipe axle, and when it is entirely erected the shoe is unbolted, the pipe pulled out, and the whole equipment moved forward to the next tower.

On ordinary ground one team can readily lift towers which do not weigh over 5000 lb. each, but if the ground is heavy or the weight of the towers is greater than this amount, it is usually necessary to provide two teams, and for towers weighing as much as 10,000 lb. it has frequently been found necessary to use three teams. Insufficient power to erect towers promptly when once started has frequently caused accidents.

Stringing the Conductors

The process of stringing conductors upon a fairly heavy line, especially if it be a double-circuit type, requires more men and is the most complex of the operations. Supposing that the line passes through a fairly well-settled district where there are frequent telephone lines, highways and railway crossings, the following organization will produce efficient results:

(1) One sub-foreman with several men and from one to two teams should precede all other crews and prepare protection for crossing telephone lines, railways, etc., and arrange for a free and unhampered roadway for the larger crews which follow. This gang might be called a "trouble crew." Then should follow:

(2) One sub-foreman with two or three laborers and several teams distributing snatch-blocks and other auxiliary appliances, such as special devices for running out ground wire, etc.

(3) One foreman in charge of about eight men and about six or eight teams which are engaged in hauling out the conductors and ground wire. In addition to these laborers and teams, this crew contains several climbers and their assisting ground men, whose business it is to lay the conductors through the snatch-blocks and make all of the splices well in advance of the sagging crew. When this crew has passed everything should be in readiness for the sagging crew to start the final process of stretching and clamping the conductors into place.

(4) One foreman in charge of a sagging crew accompanied by a sufficient number of men and teams to take care of the sagging and to provide signal men to pass signals from the front to rear over the district which is being sagged.

(5) One foreman in charge of the necessary climbers and ground men whose duty is to clamp in the conductors behind the sagging crew. This gang removes pins and lowers the snatch blocks and other appliances to the ground ready for crew No. 2 to take forward.

The length of conductor which can be successfully sagged at one pull has been lengthened by trial and experience from the original half-mile stretch until now pieces of conductor two miles in length can be successfully pulled into place in one operation. With the lengthening of the line between pulls two points of interest to construction men have developed. One of these is the fact that there is a perceptible interval between the application of the pull at the front end and the time when the conductor shows the effect of this pull at the rear end. This time interval amounts to as much as one-half minute over a two-mile pull, and after

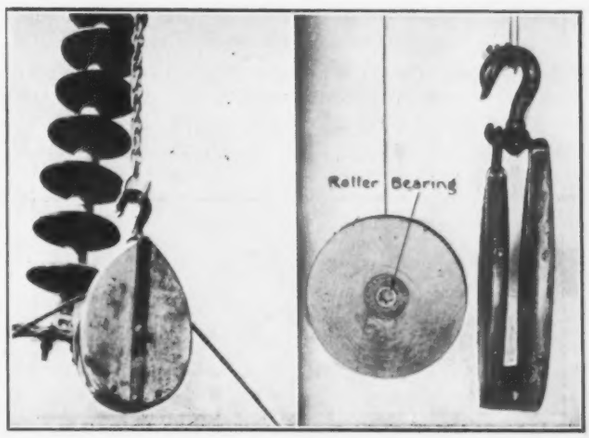


FIG. 8—10-IN. WOOD SNATCH BLOCK IN PLACE

FIG. 9—DETAIL OF SNATCH BLOCK AND SHEAVE

a crew has become skilful it will stop pulling so as to allow for this time interval.

The other is that at anchor points where the conductors are dead-ended the amount of additional slack which is distributed over long stretches of conductor is of advantage in attaching the strain clamps to the conductors. This additional slack allows the point on the conductor to which the clamp must be attached to be pulled up to a point directly under the cross-arm where the tower man, who is sitting in a boatswain's chair, can clamp to the conductor directly in front of him. If, on the other hand, the length of line being sagged is comparatively short, the available slack will not allow this to be done without overstraining the conductors and towers. It then becomes necessary to mark the point on the conductor where the clamp should be fastened, lower both clamp and conductor to the ground, and lift them into position with a second pull.

Early construction experience proved that many of the injuries to conductor were caused by the metal pulleys in the snatch-blocks with the result that wooden pulleys have now been successfully designed which will not injure the conductor. One of the successful wooden pulleys is made of lignum vitæ wood carried upon roller bearings. The thickness of these blocks should be sufficient so that the conductor will easily run in the groove without being pinched, and the width of the frame

should allow the splicing sleeve to run through without hindrance. This is especially necessary now that several pieces of conductor are sagged with one pull. The increased amount of slack to be taken up often requires the splices to run through the blocks.

Mud and water quickly cause wooden snatch-blocks to swell and refuse to turn, with the result that the conductor will stick in the blocks and sometimes blister before giving way. The blocks therefore should be carefully inspected when being picked up and moved forward. All blocks which do not run freely or are in need of cleaning and repairs should be discarded. A sufficient number of extra blocks should be provided for this emergency. If the groove in the rollers is too deep and the lips are too thin, the conductor is liable to splinter these thin edges. The groove need not be more than ⅜ in. in depth, and the edges should be turned in a flat curve.

With the rapid rise in operating-line pressures during the past few years there has been a corresponding increase in the number of porcelain disks, thus increasing the distance between cross-arms and conductors. In order to facilitate the clamping of conductors boatswain chairs to support linemen are suspended from the cross-arm. These chairs allow the men to work to good advantage and at the same time provide a safe support during the wire-stringing process. (See Fig. 11.)

Dynamometers Versus Sighting Methods for Stringing Conductors

The chief need of dynamometers in wire stringing is upon heavy, important trunk lines where continuity of

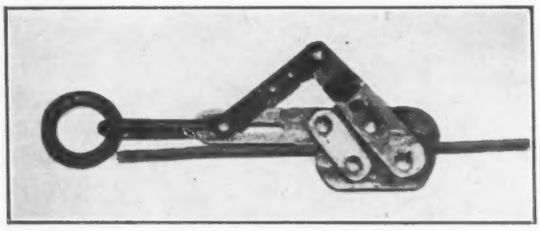


FIG. 10—SPECIAL HEAVY GRIP FOR PULLING CONDUCTOR TO 10,000 LB.

service is essential. The proper sag for a given span and temperature can be determined by the "sighting" method close enough for practical operating purposes, but this method is not applicable if the conductors are to be pulled up to full working strength for test purposes. The use of a dynamometer upon such a test pull will eliminate every point of mechanical weakness in the conductor, and it then ought to withstand the severest weather conditions for which it is designed. Dynamometers in field work are subjected to very severe service and frequently get out of repair, and therefore the sag as obtained from the indicating dial should be checked by the sighting method.

One of the simplest methods of sagging conductor by the sighting method is to select two adjacent towers which are practically at the same elevation and find the required sag corresponding to the length of span and temperature as shown upon previously prepared tables. Then set a simple target which can be plainly seen as far below the upper cross-arm as the lowest point of the properly sagged span and place a similar mark upon the other tower where the sagging man works. By pulling the conductor until it becomes tangent to the line of sight between these two targets the correct sag is easily obtained. With a little experience, all of the remaining conductors may be sagged by observation only. This is best determined from a point considerably to one side and midway between the two towers. Even a small difference in the sag curves formed by the different conductors is quickly apparent.

If it is necessary to use a dynamometer for test purposes, the extreme test pull should be applied and held for two or three minutes and then gradually reduced until the required tension is secured.

There is an opportunity for some manufacturer to improve upon the grips which are used in pulling heavy conductor for tensions above 3000 lb. There are several schemes of grips which depend upon the tightening of several bolts in order to hold firmly. This takes time, and a grip is needed which not only has a good factor of safety against slipping and bending and can safely pull up to 7000 lb. or 8000 lb., but which can also be quickly applied and easily released. Several of the more successful types of grips for smaller lines have been tried upon heavier conductors and have been found to be entirely inadequate.

Methods of Increasing Efficiency in Stringing Conductors

The wire-stringing process being the last before putting the line into operation, those in responsible charge are always anxious to drive this operation at highest speed. One successful method of increasing interest among the men is the issuing of a daily progress card which records each day's progress as well as the total progress to date and the amount of conductor still to be strung. This works especially well if there is more than one stringing crew, as keen rivalry is sure to spring up. The arrival of these daily report cards is noted and commented on by all of the field crew. When crews are working at top speed it is especially necessary for the inspector to be on the alert to avoid stringing damaged conductor or making poor splices.

Sizes of Reels

The length of conductors as drawn at the factory is controlled by the maximum weight which can be economically hauled upon its arrival in the field. Usually between 3000 lb. and 4000 lb. is all that can be handled upon rough or soft ground.

Several successful methods have been devised to support the reels of copper during the time it is being pulled out. One effective scheme may be understood by referring to Fig. 7. It consists of a demountable eccentric reel, one radius of which is greater than the radius of the reel containing the conductor. This demountable reel is attached to the inner reel of conductor and then rolled forward until the conductor is lifted free from the ground. A simple wooden brake is easily provided by placing a heavy green stick through an opening in the outer reel. This will cause friction upon the inner reel when necessary.

Upon short lines, and when time is not so important, one or two teams are sufficient to haul conductors away from the reels, but if the line is, say, 50 miles or more long, one team should be provided for each conductor so that no turning back will be necessary.

Only one team at a time works to good advantage when sagging conductors, as there is a considerable amount of signaling which could easily become confused if two teams were working at once. Furthermore, if two teams are used, a double set of climbers and ground men are needed at each of the intervening towers. The additional amount of conductor which could be strung daily by two teams would not warrant the expense involved by the increased organization.

Aluminum conductors with steel cores have some practical advantage in stringing owing to the fact that injuries to the surface of the aluminum conductor do not materially reduce its operating strength or efficiency. On the other hand, hard-drawn copper-stranded conductors must be lifted to their final position without

injury to the outer hard skin as the strength of the conductor is seriously reduced if this outer skin is nicked or scraped by dragging over rocks or by falling heavily upon any hard material. Operating records show that mechanical failures in a conductor are usually caused by some injury during construction.

Clean-Up

If every process is carried out conscientiously and thoroughly by each crew, there is really no need of a clean-up crew going over the entire line after wire stringing is complete, but in actual practice it is often found that the clean-up crew has a tremendous amount of odds and ends to take care of. The money spent upon clean-up crews does not show up well to those who are in responsible charge and is always a source of irritation if the amount is appreciable.

Notes Upon Construction Program

Owing to the fact that experienced transmission-line construction men are usually scarce, it is advisable to

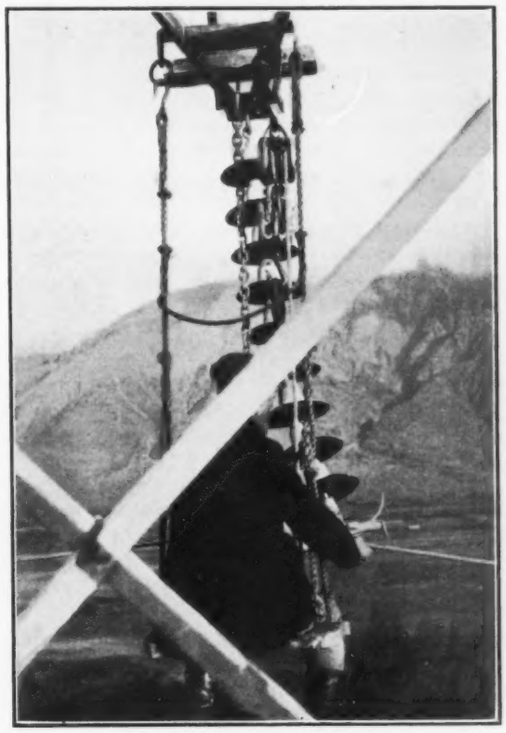


FIG. 11—LINEMAN CLAMPING-IN CONDUCTOR FROM BOATSWAIN'S CHAIR

start the erection of towers and the stringing of conductor over a territory which is favorable for this work and does not entail special difficulties. This will enable the green crews to get lined up and in good running condition before obstacles occur. This is particularly true where steep rocky country has to be crossed.

Causes of Accidents

Mechanical failures of towers after once in operation are very infrequent, and it usually takes a storm of terrific force, something in the nature of a tornado, to wreck one of these structures. Accidents generally occur during the active construction period, either by dropping the towers after they are partially erected or as a result of carelessness in leaving the backfilling of footings only partially completed over night. This statement applies to towers with footing holes left open until the towers are erected. At least in one instance several towers were blown over and very badly damaged by a heavy windstorm coming up during the night. The investigation which followed disclosed the incompleted backfill.

Special-Length Spans and Special Conductors

The practice of designers and locators to reduce the number of supports by substituting special towers and conductors with unusually long spans when the profile will permit is doubtful economy. Whenever conditions will permit the use of standard conductors and towers it will usually be best to stick to standard types from both a construction and an operating standpoint.

Once a construction organization becomes trained to a standard procedure in handling uniform-weight towers, conductors, etc., it goes forward with an increasing efficiency, but it slows up when special construction becomes necessary. Frequently entirely new equipment and methods are necessary to construct a few special spans. With an organization of considerable size the delays caused by the getting up of special equipment, etc., very quickly offset the saving of the cost of towers. This line of argument holds good whenever repairs are necessary during the operating period.

Construction Camp Details

While there is no doubt that camps of canvas are more economical in constructing pole lines and light steel-tower lines, yet there are some arguments in favor of at least semi-permanent camps when constructing a heavy tower line. It might be well to consider the possibility of building a combination cook shanty, dining-room and commissary of wood capable of giving good shelter for six or eight months. Sleeping quarters could be provided under canvas. The crews could follow each other in their occupancy of these permanent quarters but could move their own cots and bedding from camp to camp.

The advantages of this scheme are as follows:

(1) The expense and time which is used in making camps and moving and fitting up new camps could in a large measure be saved.

(2) Commissary clerks and cooks could remain in one locality during the entire progress of the work and could buy the supplies to better advantage and take care of them in better shape.

(3) The men could be more comfortably fed and housed.

(4) The camp equipment would doubtless have a greater salvage value.

The main argument against this plan is the absence of precedent, and there may be serious objections which are unforeseen at this time.

Salvage Upon Construction Camp and Camp Equipment

Salvage value upon transmission-line construction plant is probably as low as can be found in any other line of construction work. This is especially true if the company or contractor is operating in an isolated district where the equipment cannot be used for a second line to advantage. The tents and cooking utensils of all kinds will seriously deteriorate within a year's time, even though they are not in use.

Motor Trucks

The use of motor trucks is by no means new to transmission-line work, although it is doubtful if they have been used upon heavy steel tower work; but if the roads are convenient there is every reason to believe that they would be economical.

This is especially true if semi-permanent camps are constructed, as the camps can be more widely separated and the trucks can be used to advantage in transporting men to and from their work, as well as for keeping up small supplies and in emergencies of any kind.

Carbon as a Heating Element in Appliances

A Study of Resistance Characteristics of Carbon Rods and Disks— Possibility of Their Extended Use as Heating Units

BY C. W. PIPER

IN order to determine the most practical form of carbon to use as a heating element, tests were made of carbon rods of diameter varying from 1 in. to ⅛ in. of high and low resistance (different per cent carbon) and of a stack of twenty-one low resistance carbon disks 1⅛ in. in diameter and ⅛ in. thick. In order to prevent unequal cooling by drafts of air, the test sample in each case was placed in a large glass tube.

The characteristic change of resistance due to change in temperature was obtained by impressing a constant voltage and noting the current change each minute. The results were checked by maintaining a constant current and noting the voltage drop each minute for thirty minutes. Similar tests were made by placing the test sample in a calorimeter (dry) and immersing the latter in a tank of water.

The results obtained with the several rods were quite similar. The high resistance ⅜-in. rod is taken as typical of the lot, and the curves and data given below apply specifically to this rod.

Difficulty was experienced at first in providing suitable contacts for getting the current into and out of the rod. The several types of contacts tried and abandoned, on account of excessive sparking, were: clamps attached to the ends, mercury cups, and soft copper wire wound around the rod under sufficient tension to be pressed into the pores of the carbon. Copper-plated ends soon loosened and peeled off when the rod was repeatedly heated and cooled. With the various side contacts, the carbon at the surface of the rod became oxidized at a comparatively low temperature, leaving a white residue or film on the surface. This was followed by the formation of an arc moving in a spiral around the rod just under the thin film resulting from oxidation.

The method finally employed for securing suitable contact was to square and smooth the contact surfaces and then to clamp the rod on disks between two sheets of soft copper. The contact was all at the end of the rod or stack of disks, which entirely eliminated sparking. This method, however, was not entirely satisfactory, owing to the fact that the soft parts of the carbon at the contacts were burned away, leaving a pitted contact surface.

The failure of the rods with end contacts was caused by heating and not by sparking. The rod became soft, opened up or cracked along the side, and a flame sputtered out as if a gas were being burned.

Fig. 2 shows the effect of keeping the voltage constant. Fig. 6 shows the effect of keeping current constant. From Fig. 2 it is evident that for the given length of rod there is a voltage, somewhere between 350 to 425, for which the resistance would remain practically constant. Fig. 5 is the current-time curve for the rod shortened so that this "constant-resistance" voltage is 110.

The curves observed with the calorimeter were of the same general character as those shown above, except that, owing to the fact that the rod was inclosed, the heat accumulated more rapidly and the resistance change was more rapid.

The resistance of the rod under test before being heated was 1890 ohms. After 290 milliamp. had been passed through the rod for thirty minutes, the resistance dropped to 660 ohms, hot. The current was interrupted for three minutes, and the resistance increased to 1320 ohms. Then 350 milliamp. was passed through

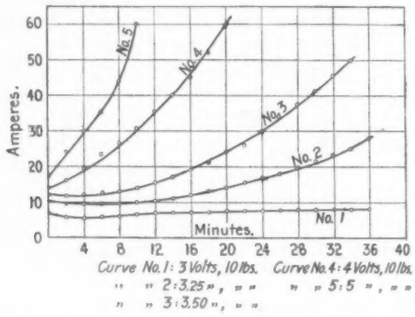


FIG. 1—AMPERE-TIME CHARACTERISTICS OF CARBON DISKS

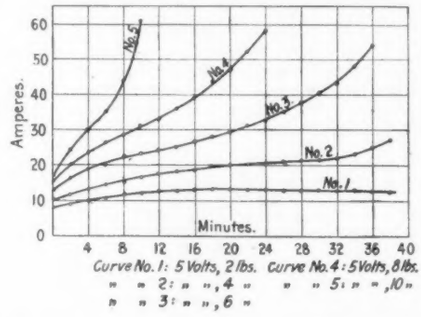


FIG. 3—AMPERE-TIME CHARACTERISTICS OF CARBON DISKS

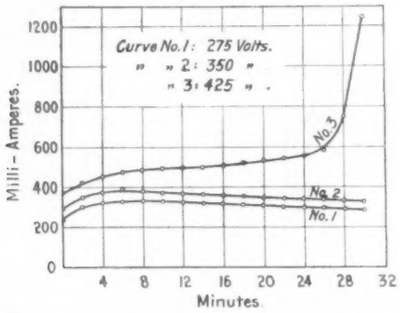


FIG. 2—CURRENT-TIME CHARACTERISTICS OF CARBON ROD

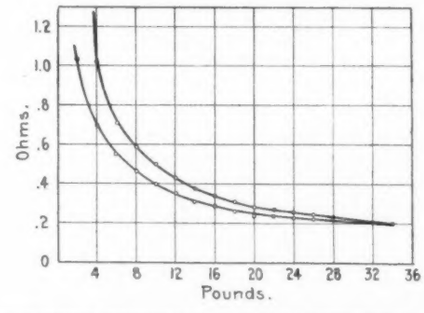


FIG. 4—PRESSURE-RESISTANCE CHARACTERISTICS OF DISKS

the rod for thirty minutes, and the resistance dropped to 740 ohms, hot. When the rod was again allowed to cool for three minutes, the resistance increased to 1680 ohms. Five hundred milliamperes in thirty minutes reduced the resistance to 650 ohms. These tests show the unstable resistance of such a rod under practical operating conditions. The carbon rod turned a very dull red at a current density of about 350 milliamp.

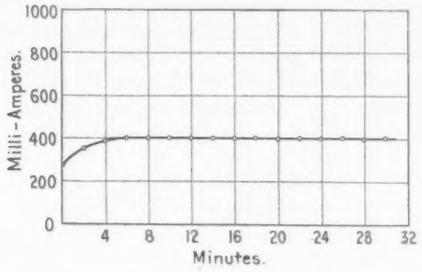


FIG. 5—CURRENT-TIME CHARACTERISTICS OF SHORTENED CARBON ROD

At 400 milliamp. the heat radiated was quite sufficient for practical purposes. It was observed, however, that the carbon oxidized at the surface, leaving a thin grayish film. The thickness of this film depends upon the temperature of the rod and the time it is kept at that temperature. The changing in the cold resistance of the rod was accompanied by the formation of this grayish white film.

The above results show that rods are satisfactory for heating units where a high temperature is not desired.

The carbon disks, however, proved more satisfactory, for the resistance of a stack of such disks could be controlled by varying the pressure. Moreover, with the disks it was not necessary to work at a temperature sufficiently great to cause oxidation, and there was, therefore, no appreciable change in the resistance of the disks at constant temperature.

A current density of 60 amp. per square inch through the disks produced very dull-red color. About 30 amp. to 40 amp. per square inch proved to be a suitable working density. A high resistance carbon disk would be preferable, for the desired temperature could be obtained at a lower current density. The change of resistance of the disks due to pressure is shown in Fig.

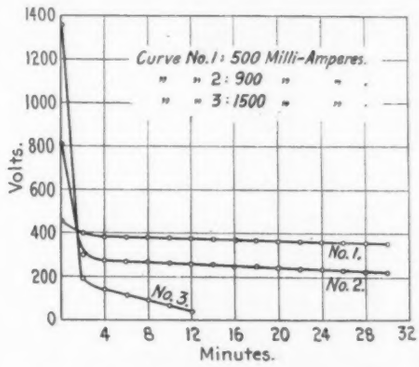


FIG. 6—VOLTAGE-TIME CHARACTERISTICS OF CARBON ROD

4. Figs. 3 and 1 show the current-time characteristics, Fig. 3 for constant voltage and variable pressure, and Fig. 1 for constant pressure and variable voltage. The carbon disks would probably prove satisfactory for use in electric soldering irons, flatirons, etc., where a variable high temperature is desired. A thumb-screw could be used to control their resistance, and any desired temperature could thus be obtained.

COST OF TRANSMISSION LINES IN NEW ENGLAND

Constructed of Wooden Poles with Metal Caps and Steel Cross-Arms

The following costs cover the recent construction of transmission lines by the Connecticut River Power Company in New Hampshire and Vermont. One line was built from Brattleboro to Bellows Falls, Vt. The poles used were standard class B chestnut, with wishbone arms and 10-in. disk insulators carrying three No. 2 three-strand copper wires for operation at 19,000 volts. A No. 6 copper telephone circuit was installed on steel cross-arms, with a special side bracket on alternate poles for transpositions. Each pole was provided with a metal cap, from which the ground wire runs to the bottom of the pole. Construction costs for 21 miles of the line are as follows:

Rights-of-way, surveys, etc.	$23,181.32
Clearing right-of-way	7,281.72
Tools	657.72
Hauling and delivering	2,977.94
Excavation	2,556.43
Setting and guying, framing and treating	4,796.98
Placing insulators and stringing wires	1,955.31
Poles	4,926.90
Wire	14,881.49
Insulators, pins, arms and hardware	6,872.73
Engineering, supervision, and general charges	4,890.00
Transformers and switch equipment	5,415.98
Interest during construction	2,400.00
Total	$82,794.52

Another line of the same construction known as the Vernon station-Massachusetts line, 8.5 miles long, has also been built recently and the following costs cover its construction details:

Lands and rights-of-way	$17,387.50
Tower-line construction	28,038.92
Switches and special construction at power house	11,507.10
Engineers' and contractors' fees*	5,931.90
Legal expense, office expenses, taxes and miscellaneous	1,784.58
Interest during construction	3,000.00
	$67,650.00

The cost of apparatus in the Vernon power-station end of the above line was as follows:

Two 150-amp, 70,000-volt, triple-pole, single-throw, solenoid-operated oil switches, complete	$2,093.00
Twelve 100-amp disconnecting switches, complete	408.30
Six 300-amp, 70,000-volt disconnecting switches, at $27.90	167.40
Two 70,000-volt aluminum lightning arresters, complete with supports, tanks, fittings, etc., at $765	1,530.00
One 20,000-volt aluminum-cell lightning arrester	360.00
Three single-pole, time-limit series relays, with switches, operating rods, bases and insulators, at $60	180.00
Six single-pole, time-limit, 100-amp, 22,000-volt disconnecting switches with 10-in. base	81.00
Steel frame for extending monitor, 48 ft., and one 24 ft.	440.00
Structural steel for two roof frames, four stubs and six brackets	222.00
Three 300-amp, 70,000-volt disconnecting switches, at $34.20	102.60
Two 600-volt, direct-current aluminum lightning arresters for telephone system, at $9	18.00
Three type H sixty-cycle, 5000-watt, 2400/240-volt secondary transformers, form K	195.52
One set cores and coils	27.00
Three single-pole, single-throw, 100-amp, 22,000-volt disconnecting switches	18.00
Fifteen knife switches, 3¾ in. wide	40.30
Insulators, pins and supports	463.29
Pipe and pipe fittings	619.50
Miscellaneous switching apparatus	162.00
Tools, etc.	389.60
Hardware	188.48
Miscellaneous materials, oil drums, etc.	201.30
Transportation of material	370.72
Labor and expenses	3,229.09
Total	$11,507.10

* Represents the overhead expense of the contractor; built on a flat-fee basis, by the Power Construction Company.

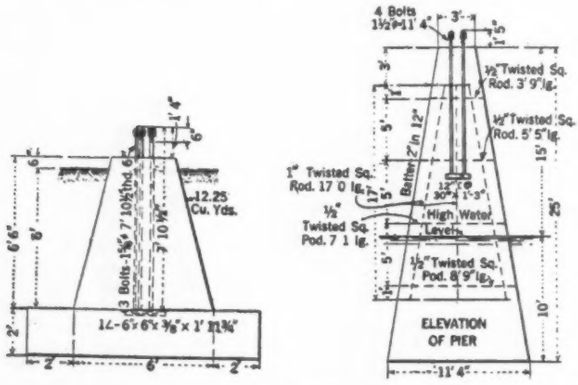
Construction of Tower Foundations

In a paper presented before the Deer Park (Md.) convention of the A. I. E. E. was described the line construction of the Toronto Power Company. It was pointed out that tower footings set in gravel or in a tightly packed mixture of sand and loam offer considerable resistance to upward pull. Where towers had to

FOUNDATIONS FOR HARDPAN, MARSHLAND AND LOOSE SOIL

be set on rock, stubs of only about half the usual length were employed, and these were set in a one-to-four mixture of concrete. Several towers had to be erected in a lake, therefore 2-in. by 8-in. tongued and grooved spruce planks were driven around the foundation stakes to serve as a cofferdam. The water was pumped out and surface dirt removed until a coarse gravel bottom was encountered. The foundations were then constructed as shown in the accompanying illustrations, the spruce sheeting being left to prevent scouring. Later 10-in. boulders were piled around the foundations to protect them from storms. It was reported that 100 hot-galvanized stubs which had been in service seven years were examined and not one showed signs of deterioration, although they had not been protected by concrete. Patent guy anchors should be used only for light construction, "deadmen" being more reliable. When more than one guy is employed on a pole galvanized turnbuckles should be used. Judging from observations extending over ten years, the author said that 40 per cent of the guys in use are unsatisfactory owing to lack of inspection. To obtain the best results anchors should be placed at a distance from the base of the pole equal to one-third the height.

In using rock bolts for anchoring care should be taken, especially if the rock is covered with a layer of earth, to place the anchor so that the ring extends just above the rock, otherwise the rod will bend. A link can be used for connecting the guy with the ring. Rock bolts should be grouted in place with melted sulphur. The



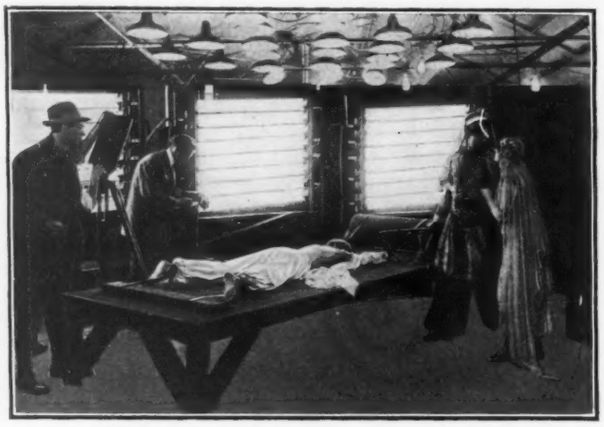
FOUNDATIONS FOR STANDARD TOWERS AND TOWERS ERECTED IN WATER

Toronto Power Company is now designing several types of new tower footings. One, intended for light windmill-type towers, is a modification of the ordinary screw-type anchor with the top shaped to fit the tower leg; another, which is intended for heavy anchor and long-span towers, has a large foot plate supported on a shallow concrete footing with an anchor similar but stronger than that for lighter towers; and the third, which is for four-circuit towers, consists of a screw pile to which a foot plate can be bolted.

Electric Sunshine in "Movie" Production in California

To save approximately $200,000 a year in loss of actors' time and interest charges on equipment on cloudy days, there has been erected at Universal City, the large moving-picture plant in southern California, an electrically illuminated studio for taking pictures when the sun is behind the clouds.

Every type of lamp and diffuser was "tried out" in an endeavor to produce an artificial illumination which would give to the pictures the same character and color quality as sunlight. The mercury-vapor lamp met this demand, although its size and shape offered some difficulties in adapting it to overhead lighting. The new gas-filled incandescent lamp, however, is well suited for such work, and by combining the two sources it is now possible to take indoor pictures that cannot be distinguished from out-of-door photography. The light from



TAKING THE FILM "UNDER THE CRESCENT" BY MERCURY-VAPOR AND GAS-FILLED LAMPS

a gas-filled tungsten lamp has much the same quality as sunlight, and the useless orange and red rays are nullified by making the globe of blue rather than clear glass.

The studio is equipped with 2000-cp. gas-filled tungsten lamps equipped with metal reflectors suspended 2 ft. from the ceiling and 8 in. apart each way. Along the sides are banks of eight 400-watt, 800-cp. mercury-vapor lamps arranged one above the other with mirror reflectors behind each unit. The banks are mounted on casters so that they may be readily arranged in position. Flood and spot lamps are used to illuminate the dark places. A scene in a moving-picture roll, in its preparation, is called a "set," and under average conditions requires a space at least 15 ft. square. The necessary lighting equipment usually includes forty-five 1000-watt, 2000-cp. gas-filled tungsten lamps overhead, four banks of mercury-vapor lamps on the sides, and two flood lamps. The latter are of the double-arc type equipped with prismatic glass to diffuse the light, and require 35 amp at 110 volts. Thus for a single "set" there may be required approximately 100,000 cp., representing an energy consumption of about 50 kw. The present electric-lamp investment in this studio is $20,000, and this, the management has announced, it is proposed to double immediately. The energy for the plant is supplied by the Southern California Edison Company.

DIGEST OF ELECTRICAL LITERATURE

Generators, Motors and Transformers

Polyphase Series Motor.—ROBERT MOSER.—A continuation and conclusion of his illustrated article on various circular diagrams for the polyphase series motor. The diagrams refer to starting, to various methods of speed regulation, to the condition of regular operation taking into consideration iron saturation, etc.—*Elek. u. Masch.* (Vienna), April 25 and May 2, 1915.

Turbo Alternators.—O. BILLIEUX.—A mathematical paper on critical speeds of turbo-alternator sets.—*La Lumiere Elec.*, April 10, 17 and 24, 1915.

Lamps and Lighting

Designation and Rating Incandescent and Arc Lamps.—The conclusion of the long discussion which followed Salomon's recent paper on the designation and rating of incandescent lamps. Bloch thought that if arc lamp engineers would not rate lamps in mean spherical candle-power they could not be forced to do so. In that case it would be best for incandescent-lamp manufacturers to introduce for incandescent lamps the rating by spherical candle-power. The introduction of the spherical candle-power into practice will be greatly facilitated if only the watts, and not the candle-power, are stamped on the lamps. It is wrong to think that the general public wants to buy lamps; if a 50-cp. lamp is offered to an ordinary man his first question will be how much will it cost to use it. The manufacturers of incandescent gas lamps never stated the candle-power of their lamps. When the inverted gas mantle was introduced the general public was not informed on candle-powers but only on the saving of gas, and this was all they were interested in. Eichel made some historical remarks on the rating of lamps, and said that if the candle-power is to be stated it might also be useful to state in addition the actinic value since with the many available sources of light such as metallic-filament lamps, gas lamps, mercury-arc lamps, flame-arc lamps, etc., not only the candle-power but also the color and actinic value are of importance. Salomon in concluding the discussion said he couldn't understand why arc-lamp engineers should be afraid of rating by mean spherical candle-power. It would have no effect at all on the consumer who hasn't known in the past anything about the candle-power of arc lamps and wouldn't know anything about it in the future. The whole proposition is that if the candle-power of a lamp is stated without further specifications or limitations it should be understood that the mean spherical candle-power is meant. Designating the lamp by the watts consumed agrees with general sales practice. Milk is sold at so and so many cents per liter without stating the nutritive value. The public will soon learn that different 50-watt lamps are not all equivalent in the light they give.—*Elek. Zeit.*, May 27, 1915.

Generation, Transmission and Distribution

Load Curve Relief Map.—MAX DU BOIS.—In ordinary load curves the abscissas are hours of a day and the ordinates represent the load in kilowatts. A relief map is obtained by adding a third ordinate which represents successive days in one or several years. Instead of a load curve in a plane one obtains in this case a surface of load curves in space. The loads in kilowatts are the vertical ordinate while the two horizontal ordinates are the successive days of one or several years and the hours of one day. On a sheet of paper this may be plotted in the same way as the topographical relief map of a mountain region. Fig. 1 gives the load relief map of a large distribution system of the company du Midi de la France. The numbers inserted in the map (which in an ordinary topographical map would mean altitudes in feet) represent the size of the load in kilowatts. The map shows clearly how the load has changed from the beginning of 1912 (top of the map) to January, 1915 (bottom of the map.) The difference in altitude between the peaks of the mountains and valleys is less in this case than in ordinary city distribution systems because in the extended system in question it has been possible to improve the power factor. How these improvements gradually proceeded is shown by the fact that in 1912 and 1913 there were still rather steep peaks while these have changed in 1914 into more massive blocks. The depression following the beginning of the war in 1914 is clearly shown. The author thinks that maps of this kind should be more generally used since they show at a glance what may be done to fill up the valleys of the load curve, for instance, by using electricity in agriculture, etc.—*La Lumiere Elec.*, May 8, 1915.

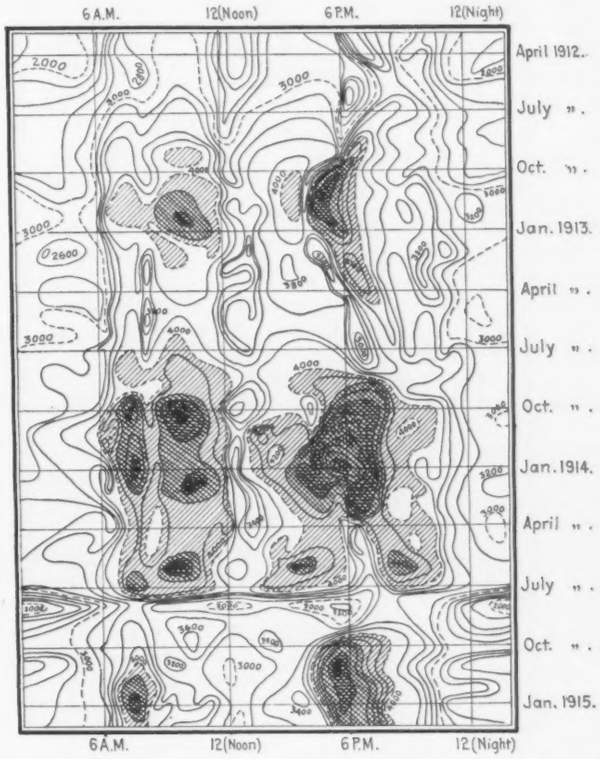


FIG. 1—CENTRAL-STATION "LOAD-SURFACE" CONTOUR MAP

Panama Canal.—EDWARD SCHILDHAUER.—A fully illustrated description of 112 pages on the use of electricity in the construction and operation of the Panama Canal. The subject is treated under the following headings: Gatun locks and dam; Pacific locks and dam; Ancon quarry; Balboa sand dock; Gatun hydroelectric station; reserve station; transmission system; distribution at locks; machinery for the operation of the locks and spillways; the towing locomotive for the Panama Canal; details of the system; details of locomotive design; the control of lock machinery; interlocking.—Supplement to *Gen. Elec. Rev.*, July, 1915.

Traction

Electric Vehicles.—RAYMOND J. MITCHELL.—An illustrated account of recent progress of the electric vehicle

in Great Britain. The uses of the industrial electric vehicle are classified under the following principal headings: (1) Public-service buses, including hotel buses and the like; (2) delivery vans from ½-ton to 1½-tons loading capacity; (3) heavy lorries from 2-tons to 6-tons capacity; (4) various special vehicles, such as tower wagons, dust carts, ambulances, water carts and municipal vehicles generally. Some statistics are given on electric vehicles in use in England and the income therefrom to central stations. The use of electric buses and the use of municipal electric vehicles for collecting house refuse and for other purposes are discussed and figures of cost are given. Notes are added on electric-vehicle charging facilities and on standardization and manufacture of electric vehicles in Great Britain.—London *Electrician*, June 18, 1915.

Oil-Electric Locomotive.—An illustrated account of a demonstration at Birmingham of a 200-hp. oil-engine-driven locomotive coach which has been fitted with the Thomas system for use on the New Zealand Government Railways. The Thomas system employs two electrical machines (each about one-third of the power of the engine) and a planetary gearing which connects these machines with the engine and the load. During starting and acceleration the power is transmitted partly mechanically and partly electrically to the wheels, but when full speed is reached the whole of the power is transmitted directly from the engine to the wheels.—London *Elec. Review*, June 25, 1915.

Installations, Systems and Appliances

Municipalization of Berlin Electricity Works and a New Electrochemical Nitrate Plant.—The Berlin Electricity Works, which have heretofore furnished the whole of the electricity supply in Berlin, will be taken over by the city of Berlin on Oct. 1. The purchase price is about $32,500,000. The power plant at Bitterfeld using fuel from adjacent lignite mines will not furnish energy for transmission to Berlin, as originally intended, but the energy will be used directly at the power plant for an electrochemical process, for the fixation of atmospheric nitrogen for the production of calcium cyanamide from which nitric acid is to be obtained for explosives. Part of the cyanamide is to be used as fertilizer. It is stated that the power house will furnish energy to the cyanamide plant at a price as low as 0.25 cent per kilowatt-hour. It is intended to erect for this purpose a generating station for an output of 180,000 kw., divided among eight units, each of 22,500 kw., of which four sets are said to be already under construction and are to be brought into operation by the end of the present year.—London *Elec. Review*, June 18, 1915, and London *Elec. Eng'ing*, June 17, 1915.

Tariff in China.—L. SCHMIDT-HARMS.—Some notes on the tariff used by Tsinanfu central station in China. The customers have the choice between meter tariff and flat rate. With meter tariff a monthly meter rent of 75 cents is charged, and the kilowatt-hour is figured at 17.50 cents. The flat rate is based on the assumption of an average daily use of the lamps for ten hours, and 1 cp. is figured at 5 cents per month, hence a 10-cp. lamp at 50 cents a month and a 16-cp. lamp at 80 cents a month. With this system the flat-rate consumers pay for 50 per cent more energy than they use. Nevertheless, 70 per cent of all consumers use the flat rate and only 28 per cent the meter rate, while 2 per cent use both flat rate and meter rate. Consumers using the meter rate are 67 per cent foreigners (Europeans, Americans, and Japanese) and 33 per cent Chinese. The preference for the flat rate is increasing, and an attempt is made to encourage this. Current-limiting devices have the disadvantage that they do not limit the hours of use of the lamps nor do they adapt themselves to the fluctuations of the demand of the consumers during the different hours of the day. The author has developed a regulator which is automatically adjusted by an electromagnetic clock device for different power consumptions for the different periods of the day. For instance, a consumer may have twenty lamps, each of 25-cp., and may want to burn twelve lamps from 6 p.m. to 12 p. m., three lamps from 12 p. m. to 5 a. m., ten lamps from 5 a. m. to 8 a. m., and no lamps from 8 a. m. to 6 p. m. The controlling apparatus is then set so that it automatically adjusts itself at 6 p. m., 12 p. m., 5 a. m. and 8 a. m. to the maximum current desired in these periods. For a 25-cp. lamp used for one hour a day a monthly charge of 18 cents is made; for two hours, 34 cents, etc.; for six hours, 63 cents, etc.; for twelve hours, 85 cents. Whenever a consumer wants to use temporarily more energy than has been contracted for, the regulator is short-circuited by the central station.—*Elek. Zeit.*, May 20, 1915.

British Electric Power Supply in War Time.—In connection with the manufacture of war supplies British central stations are very busy in providing electricity, and it is thought that the provincial electricity undertakings should have a fine record at the end of the war, which will prove conclusively that the electric motor is the ideal industrial power agent. Some figures of the increased use of motors in British stations are given. —London *Electrician*, June 18, 1915.

Automobile Accessories.—In an illustrated article F. W. Young describes the quantity production of starting motors, lighting and ignition generators, and other electrical accessories for automobiles. In another illustrated article C. E. Wilson describes recent developments in Westinghouse lighting and ignition generators and starting motors, a complete outfit of which consists of five units; an ignition device, a generator, a regulator for the generator, a starting motor and a battery.—*Elec. Journ.*, July, 1915.

Wires, Wiring and Conduits

Substitutes for Copper and Rubber.—The Austrian Electrical Society has worked out regulations concerning substitutes for copper and rubber during the war time, in conjunction with the German regulations and the Austrian department for commerce has adapted these regulations.—*Elek. u. Masch.*, (Vienna), May 9, 1915.

Voltage Drop in Alternating-Current Lines.—H. B. DWIGHT.—The author gives a simple chart for estimating the voltage drop of overhead alternating-current lines and discusses the principle by a series of vector diagrams. The chart is chiefly useful to solve two problems. One is to find the voltage drop for a given line and a given load. The other is to find the required size of conductor for a given load and a given line drop.—*Elec. Journ.*, July, 1915.

Electrophysics and Magnetism

High Permeability in Iron.—ERNEST WILSON.—An abstract of a (British) Physical Society paper. Subjecting iron to a strong magnetic force has the effect of reducing the permeability and increasing the hysteresis loss for given values of the magnetic induction. The effect can be largely removed by careful demagnetization. It was thought that the earth's magnetic force might also have a polarizing influence upon exposed iron, and an effort has been made to remove it by placing the specimen in a magnetic shield and carefully demagnetizing it. The permeability corresponding to small values of the magnetic induction is thereby considerably increased and the hysteresis loss diminished. After a long period of rest in the shield the permeability has somewhat diminished, and on taking the

specimen out of the shield it maintains its high value. Next as regards higher forces. The specimen in this case is not shielded, but is subject to a magnetizing force during the time that it is allowed to cool through the temperature of recalescence. With either an alternating or a steady magnetic force, a maximum value of the permeability of over 10,000 is obtained. In these experiments the material has been tested in the form of laminated squares or rings. With straight strips 8 cm. long, 1.5 cm. wide and 0.053 cm. thick, built into the form of test pieces, the effect, though produced, could not be maintained, and the specimen with ordinary handling was reduced to the normal state.—London *Electrician*, June 11, 1915.

Units, Measurements and Instruments

Induction Coils.—E. RAVEROT.—An article giving historical notes on the invention of the induction coil. The author gives an account of the work of Faraday (1831), Henry (1832), Page (1836), Sturgeon (1837), Neef (1838) and Ruhmkorff (1850). The author distinguishes two kinds of induction coils—one, medical coils which may be called after Sturgeon, and the other, spark coils, known under the name of Ruhmkorff, which name may be retained without overlooking in their description the important improvements of the condenser due to Fizeau.—*La Lumiere Elec.*, April 17, 1915.

Galvanometer Shunt.—R. EDLER.—An article giving simple formulas for calculating the shunt resistances of moving-coil galvanometers. The use of the formulas is illustrated by numerical examples.—*Elek. u. Masch.* (Vienna), April 4, 1914.

Cable Tests.—R. SANDSTROM.—A mathematical paper on the theory of the Delon apparatus for tests of armored cables.—*La Revue Elec.*, Jan. 15, 1915 (published April 16, 1915).

Electric Supply Meters.—S. EVERSHED.—A long abstract of his report, mentioned before in the Digest, on the variable resistance to motion offered by the registering trains of electric supply meters.—London *Electrician*, June 4, 1915.

Mutual Inductances.—GEORGE A. CAMPBELL.—A mathematical note on mutual inductances with a circuit composed of straight wires.—*Phys. Review*, June, 1915.

Telegraphy, Telephony and Signals

Electrolytic Luminosity for Phototelegraphic Receiver.—L. H. WALTER.—In the Wehnelt interrupter the anode becomes luminescent when the voltage drop in the apparatus is above a certain value. Sebor and Simek have found that the luminosity is affected by impurities in the aluminum. J. J. Johnstone has shown that aluminum alloys which contain up to 10 per cent of metal, like copper, tin, etc., which has itself no valve effect, give much better luminosity. The author has taken up these experiments using the commercial alloy duralumin which contains neither tin nor zinc, but 3.5 per cent to 5.5 per cent of copper, 0.5 per cent of magnesium and a small amount of manganese. These alloys can be used without being destroyed in sodium tungstate or molybdate as electrolyte. In these experiments glass vessels which contained the electrolyte became soiled in time so that the experiments had to be interrupted. The author has, therefore, done away entirely with the containing vessel and uses a thin layer of electrolyte wetting the surface of the anode. A piece of crape stretched on the anode permits the liquid to flow over the anode and keep it wet. By means of a centrifugal pump the circulation of the electrolyte is maintained continuous. This principle of construction permits the design of apparatus in which the anode consists of a large number of elements encased in a hard-rubber frame. In this way a kind of visual receiver for phototelegraphy and telectroscopy is obtained. In this apparatus 5500 luminous elements with independent electrical connections are placed together in a frame hardly larger than that of an ordinary camera. This makes 3240 elements per square decimeter. Fig. 2 shows the arrangement. The anodes *s* are embedded in an ebonite plate *e*, their backs being wet by electrolyte which escapes from the holes *h* of the pipe *p* and flows

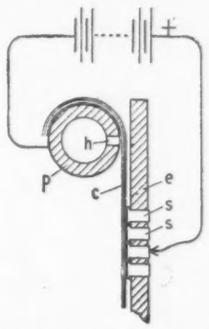


FIG. 2—CONSTRUCTION OF VISUAL RECEIVER

over the crape *c*. The most practical voltage is 130 volts to 140 volts. The negative pole of the circuit is connected to the pipe *p* while the anodes *s* which are to be rendered luminous are connected to the positive pole. This arrangement can be used for various applications, as it combines in a limited space almost an unlimited number of elements, the surface of which can be made luminous or darkened hundreds of times a second at will. The degree of luminosity can be adjusted by the voltage applied.—From *Proceedings Royal Society*, A, Vol. 90, May 28, 1914, translated in *La Lumiere Elec.*, April 10, 1915.

Wireless Telephony.—H. J. ROUND.—An extract from an article in the "Yearbook of Wireless Telegraphy" on recent progress made by the Marconi company in wireless telephony, with some editorial comments. The reaction vacuum tube is now being applied to wireless telephony by the Marconi company. The tube is partly used for the production of continuous oscillations and partly for the magnification of the signals that are received. One of the most interesting points is the fact that extremely small aerial currents, such as 0.2 amp, are sufficient to enable speech to be transmitted a distance of 70 km (42 miles). Telephone sets based on this principle, delivering 0.6 amp to the aerial, are now sufficiently commercial to be guaranteed for a distance of 50 km (30 miles) between ships at sea, and thus it seems that wireless telephony is on a fair way to substantial progress.—London *Electrician*, June 4, 1915.

Battery-Bell Signaling Systems in Mines.—The first part of an account of Dr. Wheeler's British home-office report on the danger of ignition of firedamp-air mixtures.—London *Elec. Review*, June 11, 1915.

Wireless Telegraphy.—L. B. TURNER.—An abstract of a paper read before the (British) Institution of Post Office Electrical Engineers on various types of call apparatus for wireless telegraphy.—London *Elec. Review*, June 11, 1915.

Miscellaneous

British Municipal Electrical Association.—A full report of the recent convention of the (British) Incorporated Municipal Electrical Association held in London. On account of the war there were no social functions nor were any technical papers presented. The program was restricted to the presentation and discussion of two reports on the Point Five Tariff and the Use of Electrical Vehicles in Municipal Service respectively.—London *Electrician*, June 18, 1915.

Book Reviews

How to Make a Transformer for Low Pressures. By Prof. F. E. Austin, Northfield, Vt. 14 pages, illus. Price, 25 cents.

This booklet should prove useful to amateurs wishing to construct small transformers. The directions are clear, and satisfactory results should be obtainable by any reader who will carefully follow the instructions.

Consumers' Accounts and Meter Department Routine. By A. C. Glover. London: Electrical Press, Limited. 50 pages, illus. Price, 5s.

This book contains fac-similes of twenty-nine forms for use by electricity-supply companies, adapted principally to the methods of English companies. Forms are provided for all departments of central-station records and accounting.

Annuaire Français de l'Electricité. Paris, France: La Lumière Electrique. 421 pages. Price, 4 francs.

This volume contains a complete list of all the French central stations, with data concerning their equipment, and a list of all the official and other electrical associations in France, as well as government bodies having supervision over public utilities, including the personnel of these various committees and societies.

Public-Utility Economics. New York : West Side Young Men's Christian Association.

At the invitation of the Finance Forum of the Young Men's Christian Association, men prominently associated with the financial, engineering, operating and manufacturing branches of public utilities addressed the West Side branch in New York. The present volume contains a summary of each lecture presented and a full index of the subjects and references.

Proceedings of Association of Iron and Steel Electrical Engineers, 1914. Eighth Annual Convention, Cleveland, Ohio, Sept. 14-19. 722 pages, illus. Price, $5.

This volume contains a valuable collection of papers of direct interest to electrical engineers in the iron and steel industry. Each author presents the latest theory and practice in the field described, much of which data is not yet found in textbooks. The discussions of the papers, the numerous curves and diagrams and other illustrations add value to the volume as a reference book of modern practice.

Directions for Designing, Making and Operating High-Pressure Transformers. By Prof. F. E. Austin, Montpelier, Vt. 46 pages, 21 illus. Price, 50 cents.

As a complete problem or example in transformer design this little book has appreciable educational value. It gives clear directions and provides the necessary data for constructing a practical 3-kw., 20,000-volt transformer. Notwithstanding the fact that theoretical considerations and explanations are not omitted, this book alone would not give the necessary training in fundamental principles to the engineering student. The book may be read and applied to useful ends without requiring a concentrated and sustained mental effort, but, in conjunction with other class books, both this and the booklet by the same author on low-tension transformer design should be of value.

Jahrbuch der Elektrotechnik for 1913. By Dr. Karl Strecker. Munich and Berlin: R. Oldenbourg. 249 pages, 33 illus. Price, 10 marks.

This is the second annual appearance of a series of volumes intended to do for electrotechnics in the German language what "Science Abstracts, Engineering" seeks to accomplish in the English language. The work is divided into five sections as follows: Introductory, electromechanics, electrochemistry, electric signaling, measurements and scientific researches. The work is further subdivided into eighteen chapters, or about four chapters to each section. The material for the preparation of each chapter or subdivision of a chapter has been divided among nearly sixty specialists, all working under one editor. The treatment of each subject is distinct from that of "Science Abstracts." It consists of a brief review of the progress made during the year 1913 in each department with references to the literature in which that progress is described. There is thus much more of a personal or individual character in the German yearbook than is to be found in "Science Abstracts." In some respects this may be regarded as an advantage, while in other respects it may be considered a disadvantage. At all events, it is probably better to have the German record kept in a distinctive manner so as not merely to reduplicate in the German language what appears in the English electrotechnical record. The work has been carefully done, and the tracing of any particular contribution is easily carried out.

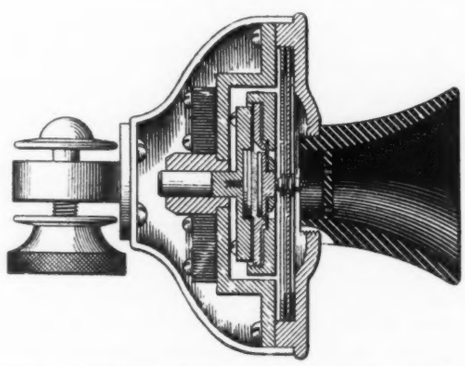
Book Received

Shrapnel and Other War Material. A reprint of important articles presented in the *American Machinist*. New York: McGraw-Hill Book Company, Inc. 92 pages, illus. Price, $1.50.

RECENT TELEPHONE PATENT

Improved Transmitter

The resistance element of a telephone transmitter—that is, the microphonic button—may become very hot if excessive currents are used. If the heat becomes too intense the granules of carbon may even burn. The temperature attained depends upon the radiation and



TELEPHONE TRANSMITTER DESIGNED TO CARRY LARGE CURRENTS

the heat conductivity of the surroundings. To allow the employment of larger currents, Mr. David Koenig of New York City has designed a transmitter with the button seated in a heavy metal block having a large radiating surface as shown in the sectional view. The patent for this transmitter (No. 1,138,959) has been assigned to the Western Electric Company.

POWER AND OPERATING SECTION

Girders Over Coal Bunkers Protected with Concrete

The girders over the coal bunkers at the Gold Street station of the Edison Electric Illuminating Company of Brooklyn are protected from possible injury by spontaneous combustion of the coal by a 1.5-in. coating of concrete applied with a "cement gun." To apply this coating a hexagonal-mesh wire cloth made of No. 18 wire is wrapped around the steel and a mixture of one part of cement and three parts of sand spread over this with the gun. The cement and sand are forced through a hose in a dry state at a pressure of about 35 lb. per square inch and mixed with water under 45-lb. pressure at the nozzle.

This process, the company declares, has several advantages over hand work. In the first place, the chemical combination or initial set takes place at exactly the right place, namely, the final resting place, and not on the mixing board. Again, only the required amount of water for hydration is used, and on account of the pressure maintained in applying the materials, all surplus water and air are expelled. The maintenance of this pressure also assures a uniform mixture and a homogeneous mass. Another big item in favor of this process is the absence of forms, which, under the usual conditions of construction, represent an extra expense.

A Double Safety-Valve Protection and Good Operating Facilities Around Boilers

In the steam plant of a Massachusetts mill now approaching completion, an interesting safety valve arrangement has been installed as shown in Fig. 1. In place of a single 4-in. valve, each of six 150-hp. boilers of the plant is equipped with a pair of 2.5-in. Ashton safety valves connected with the boiler by a common riser. These valves are set so that one opens at a pressure of 3 lb. per sq. in. below the opening pressure of the other. In case the steam pressure exceeds normal for a short time the opening of one of these valves disturbs the conditions within the boiler much less than as though a single larger valve were used. If the pressure continues to rise, the opening of the second valve relieves the situation so that adequate protection is combined with flexibility of operation.

FIG. 1—SAFETY VALVES SET FOR DIFFERENT PRESSURES

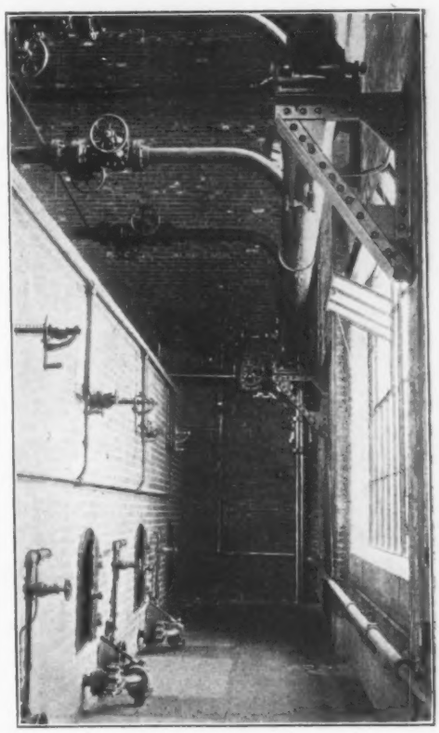


FIG. 2—GOOD LIGHTING AND ARRANGEMENTS FOR WORKING ON BOILERS

At the rear of the boilers, good natural lighting and ample space is provided, features that are often overlooked in this portion of a steam plant. A passage 6 ft. wide extends the entire length of the boiler room, with an arrangement of blow-off valves and piping, tube-cleaning equipment, steam jets and live-steam piping, which provides unusual facilities for inspection and manipulation. The installation was photographed before the piping was covered; however, all exposed piping will be amply covered. In Fig. 2 the steam header of this installation is shown on rollers supported by steel brackets and within comparatively easy reach of operators.

A Book That Helps the Trouble Department

In the trouble department of the Columbus (Ohio) Railway Light & Power Company a loose-leaf file book 5 in. by 7 in. contains blueprints that show the extent and direction of every secondary circuit on the company's system. The pages of this book show the circuits connected to a certain single transformer or bank of transformers, and are arranged in the order in which

the circuits they show are taken from the primary circuits. Indexed leaves at intervals through the book help to locate prints of primary circuits. The tabs on these indexed sheets show which primary circuit serves the transformers indicated on the adjacent secondary pages.

When the trouble dispatcher receives a telephone call from a consumer and learns that all lights are out, he immediately sends a motorcycle repairman to the location of the trouble according to the telephone call. If within the next few minutes more calls come from the same neighborhood, the dispatcher consults the blueprint book. If he notes that the calls have come from customers served from the same transformer installation, he assumes that the transformer fuses are blown and starts another motorcycle man direct for the transformer itself. Very often the second man, on account of additional details concerning the trouble, reaches the transformer and replaces the blown fuses by the time the first man has completed an inspection at the premises of the first customer reporting the trouble. This practice, it is said, has done much to establish for the company a reputation for restoring impaired service quickly.

Two Synchronous-Motor Protection Schemes

By E. E. George

In a plant where a synchronous motor was subject to rough treatment it was found necessary to devise a protective device that would cut the motor off the line in the following cases:

(1) Motor thrown on the line when so far out of synchronism as to shock the machine or system.

(2) Motor thrown on the line without excitation or with excitation so high or so low as to shock the machine or the system.

(3) Removal of excitation while the motor is on the line.

(4) Change of excitation with motor on line so suddenly as to shock the machine or system.

(5) Motor thrown on the line at standstill.

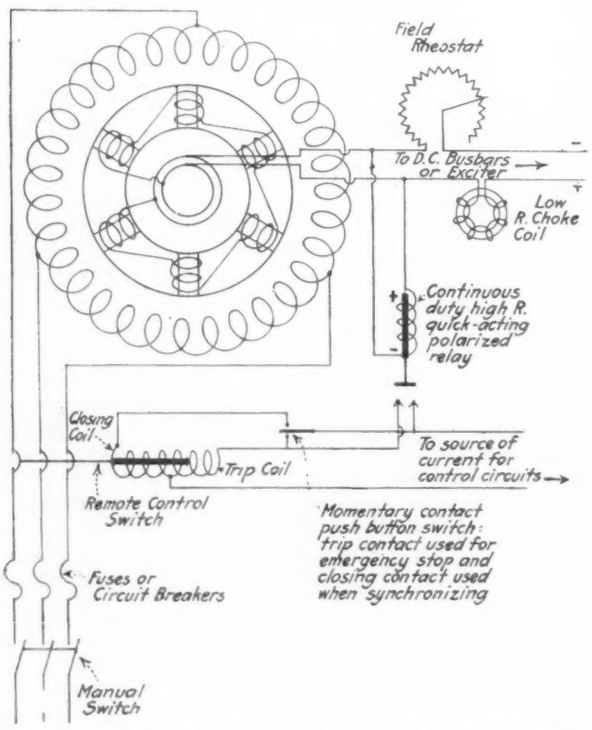

Field Rheostat
To D.C. Busbars or Exciter
Low R. Choke Coil
Continuous duty high R. quick-acting polarized relay
Closing Coil
Trip Coil
To source of current for control circuits
Remote Control Switch
Momentary contact push button switch: trip contact used for emergency stop and closing contact used when synchronizing
Fuses or Circuit Breakers
Manual Switch

FIG. 1—CIRCUITS OF SCHEME TO PROTECT SYNCHRONOUS MOTOR

(6) Motor overloaded so as to pull out of synchronism.

(7) Motor falling out of step due to hunting.

(8) Motor falling out of step due to sudden change in mechanical or electrical load.

The machine in question was a specially designed alternator adapted for either motor or generator operation, and arranged for single-phase, two-phase or three-phase connection. It was connected to a direct-current machine, the whole set being a part of the equipment in the testing department of the American Rotary Valve Company of Anderson, Ind. The machine was often synchronized with the mains of the municipal lighting plant and with another synchronous generator in the test department and run at almost every conceivable frequency, voltage, mechanical load, electrical load and power-factor.

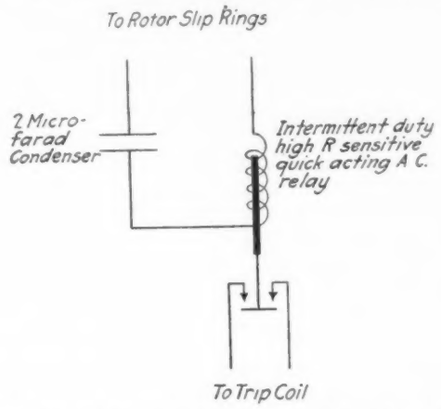


FIG. 2—RELAY AND CONDENSER TO REPLACE CONTINUOUS-DUTY RELAY OF FIG. 1

With 220 volts on the stator, nearly 6000 volts were induced in the rotor at standstill, causing a flash to ground at several points and threatening the destruction of the rotor insulation whenever this happened. It was, therefore, necessary to prevent the machine being thrown on the live lines when not in synchronism, particularly since the motor was not self-starting in the ordinary sense of the word. When normal voltage was impressed on the stator and the rotor was not driven mechanically, it would come up to half speed if the field winding on the rotor was short-circuited or if the high induced voltage produced a power arc at the slip-rings. If given mechanical assistance between half and three-quarters speed, the machine would come up nearly to speed and run as an inducton motor, with but slight load capacity. With a normal or slightly weak field, the machine would come into synchronism. If not nearly up to synchronous speed, the field current had no effect on the behavior of the machine.

The use of quick-acting circuit-breakers in the lines to the motor would not save the rotor in case the machine fell out of step, since the current drawn from the lines would be less than the full-load current of the machine. The first scheme tried, which worked very successfully, was the shunting of a sensitive high-resistance polarized relay directly across the slip-rings of the rotor. A small part of the field excitation current flowed through this relay, and with sufficient excitation to generate a voltage high enough for safe and effective synchronizing, was powerful enough to hold the lever of the relay down, thus holding the auxiliary circuit of the relay open. This auxiliary circuit was the trip circuit of a remote control switch in the three-phase lines running to the motor. Removal of field, sudden change of excitation, zero, sub-synchronous or super-synchronous speed of motor, a sudden change in

mechanical or electrical load, were conditions that would cause an alternating or oscillatory current to be induced in the rotor circuit, which induced current, momentarily at least, would act in opposition to the direct current in the polarized relay and allow the lever to release. This action would close the circuit of the trip on the remote-control switch and cut the motor off the busbars. The induced current passed mostly through the relay in preference to the inductive armature circuit of the exciter. An inductor in the armature circuit would have increased this effect.

The second device, which worked even better, was a variable condenser in series with a sensitive low-resistance relay shunted across the slip rings. An inductor of low resistance was placed in the exciter armature circuit. Normally, there was no current in the relay, as the direct-current excitation could not pass through the condenser. When an alternating or oscillatory current was induced in the rotor, the relay lever closed the circuit of the trip on the remote-control switch, cutting the motor off the busbars. A push-button in the closing circuit of the remote-control switch proved a very convenient device for accurate synchronizing, being more readily closed than a large three-pole switch.

The responsiveness of the protective device was based upon the fact that at the moment of pulling out of synchronism from any cause whatsoever a very pronounced surge was induced in the rotor circuit, often of greater magnitude than the normal direct-current excitation. This caused the relay to operate with a surprisingly small time element. If this surge did not occur, the relay would defer operation until the slip of the rotor from synchronism was sufficient to induce a high enough voltage to operate the relay on the alternating current of the existing frequency.

Indirect Lighting in Stations

Particular attention has been paid to the lighting of the 187th Street substation of the United Electric Light & Power Company, New York City. The switch operator's compartment and the transformer room adjoining it are equipped with indirect-lighting units suspended below concrete ceilings. In the transformer room, which is 26.5 ft. wide by 57.75 ft. long by 32 ft. high and has white ceilings and yellow walls, twenty-five lighting units are arranged in three rows along the ceiling 6 ft. apart and 26 ft. to 30 ft. from the floor.

The central row consists of five indirect units, each containing four 100-watt tungsten lamps. In the two outside rows is a total of twenty direct-lighting units, each containing one 150-watt lamp. Sufficient illumination for ordinary operations is afforded by using the indirect units alone.

The operator's compartment, which is 82 ft. long by 11 ft. 5 in. wide by 14 ft. 2 in. high, receives some light from the transformer room, but its main illumination is furnished by eight indirect lighting fixtures. Each of these contains one 150-watt lamp, and the units are arranged 9.5 ft. apart and 11 ft. above the floor. The latter is covered with cork tile, and the switchboard is made of black slate. X-ray reflectors are used in each fixture.

In the bus and switch compartment gallery the lamps are not exposed but are covered by diffusing lenses set flush with the ceiling. This equipment does not hinder men working on the upper switch compartments. As the walls of the gallery and compartment are white, the illumination inside an opened compartment is very satisfactory.

SUBSTATION ILLUMINATED BY INDIRECT LIGHTING FIXTURES

Handling Heavy Transformers with a 2-Ton Electric Truck

The Southern California Edison Company makes use of a 2-ton General Vehicle Company electric truck for transporting and raising into place heavy transformers installed on its system around Los Angeles. The transformers are hauled on the body of the truck, although sometimes, when several are to be transported, one is carried on a "dolly" used as a trailer.

For hoisting the transformers into place a special tackle, locally known as a "Sweeney rig" from the name of the foreman who devised it, is set up on the pole as shown in the illustration. Through a pulley block at-

A 2-TON ELECTRIC TRUCK RAISING A 50-KW. TRANSFORMER

tached to the base of the pole is carried the chain and running rope to be attached to the rear of the truck, which is backed up close to the pole. The hoisting rig is at the same time hooked over the transformer standing on the truck, and the truck is started forward. As the tackle is all set up in place by the time the electric vehicle arrives, it is usually a matter of about a minute to get the transformer swinging in the air. A crew of three men and driver can get a transformer into place in a few minutes by this means with little effort, whereas formerly it took a dozen or more men and a lot of time and hard work.

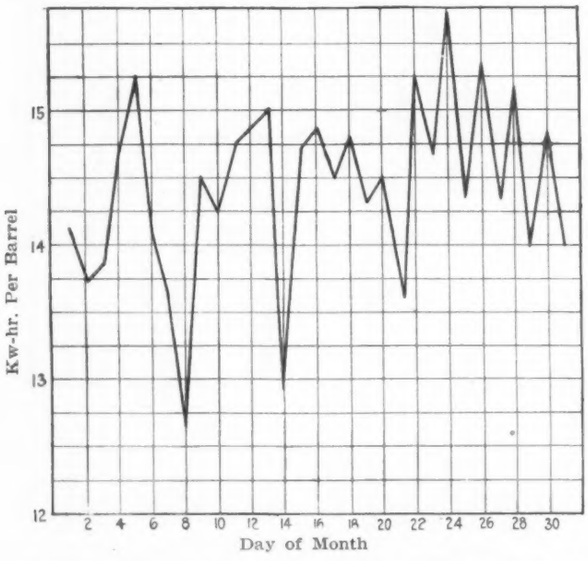
No winch is employed on the truck as it has been found in practice that under the conditions prevailing in Los Angeles, the driver can nearly always get a straightaway pull. As the electric truck starts and accelerates without jerking, this type of vehicle is found much superior to a gasoline car for the work.

Need of Studying Energy Consumption of Manufacturing Operations

In most industries there are ample opportunities for reducing production costs by studying the fluctuations of power required for different operations and making changes which will make the load more uniform. Usually the need of studying loads is made evident by the irregularity of the total load curve or by a unit-power-demand curve taken over a long period.

For instance, the accompanying curve representing conditions in a cement mill, shows that the energy per barrel of cement manufactured varied from 12.65 kw.-hr. to 15.25 kw.-hr. in thirty-one consecutive days. In some cases this variation can be accounted for by the hardness or size of the raw product from which the cement was made. In many cases, however, the motors do not have uniform loads, in which case it is necessary to re-group the machines driven from the same motor.

Not infrequently it will be found that a high unit demand is caused by operating cement machines below

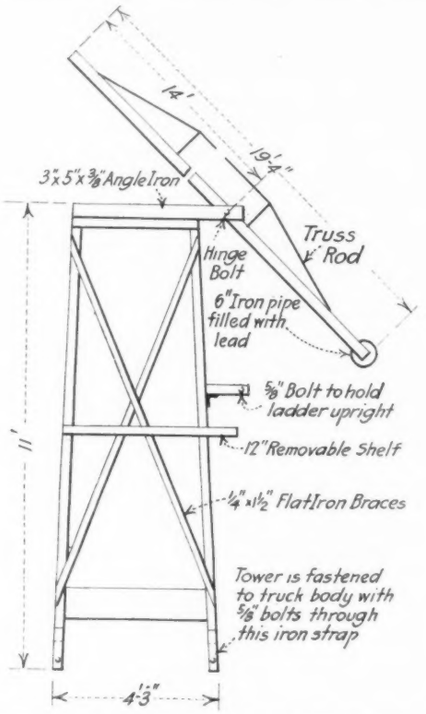


ENERGY REQUIRED BY A CEMENT MILL PER BARREL OF CEMENT MADE

rating. In any case it should be the aim to operate all machines as near their rating as possible, grouping those which operate simultaneously so they can be driven by one motor. One of the best methods of determining when and where to re-group machines is to study the records of loads taken by recording instruments.

Portable Tower for Maintenance of Street Lamps

For facilitating the cleaning and inspection of street lamps in Pittsburgh, Pa., the Duquesne Light Company has developed a portable tower which will pass under ordinary overhead obstructions like trolley wires, railroad crossings, etc., and can be carried on a small electric truck. Heretofore lamp inspectors were required to ascend poles on ordinary ladders, which might



TOWER FOR MOUNTING ON TROUBLE TRUCK

slip or be knocked from beneath them. The new tower affords safety because of its thorough stability. Furthermore, the speed of trimming lamps has been increased about 75 per cent, and the actual cost of maintenance is reported to be about ten per cent lower than formerly. Lamps supported inside curb lines at a height of 14 ft. or units suspended 29 ft. above the street on brackets attached to span-wire poles can be inspected from the towers with equal facility.

The construction and dimensions of the new equipment are shown in the accompanying line drawing. The tapered frame base is made of four 2-in. by 4-in. wooden uprights held together at top and bottom by 2-in. by 6-in. planks and cross-braced with 1.5-in. by 0.25-in. iron straps. On the platform at the top and extending 6 in. over one edge of it are fastened two 3-in. by 5-in. by ⅜-in. angle irons, between which is pivoted a 19-ft. trussed and counterweighted ladder. The axis about which the ladder turns is an 0.75-in. bolt passing through the holes occupied by the rung it replaces. Three-eighths-inch rods arranged like trusses on each side of the ladder prevent its bending to any considerable extent. As the upper part of the ladder is 14 ft. long and the lower part only 5 ft., a 1-ft. length of 6-in. pipe filled with lead is fastened in the position of the lowermost rung to facilitate erecting the ladder.

By the aid of a small overhead, hand-operated crane the tower can be hoisted and fastened to any vehicle platform in five minutes. If other facilities are not available, it can be lifted by four men in about the same time. Iron straps measuring 0.5 in. thick by 3 in. wide by 12 in. long are attached to each leg of the tower for fastening it to a vehicle.

COMMERCIAL SECTION

Winning Old Houses by Special Inducement

A Wiring Campaign in a Small City that Succeeded in Spite of a Saturation Factor of Seventy-Four Per Cent

CENTRAL stations operating in large cities have repeatedly inaugurated house-wiring campaigns and achieved remarkable results in the number of houses wired, often because of the very large number of houses which previously were unwired and the consequent wide field for activity. In the small town with a population under 10,000, however, it is another story.

---: WIRE YOUR HOME FOR :---
ELECTRIC LIGHTS!!
Would You Like To Have ALL Portions Of Your House Well-Lighted
Would You Like To Be Rid Of Flickering, Smoking Lamps And
Blackened Chimneys? Would You Like To Know The
Real Meaning of "Safety First" in Lighting?
OUR
Agreement
House Wiring
BARGAIN!
3 MONTHS Free Light 3
Workmanship Guaranteed.
YOUR
Advantage
HOW WE CAN DO THIS?
By A Fortunate Purchase Of A Great Quantity Of Wire Are Able
To Offer You This Bargain Of Real Value
OUR SOLICITOR WILL CALL ON YOU
Eastern Michigan Edison Company

THE ADVERTISEMENT THAT BROUGHT THE BUSINESS IN THE MOUNT CLEMENS CAMPAIGN

Mount Clemens, Mich., according to the census of 1910, has 7707 inhabitants and is served with electrical energy by the St. Clair division of the Eastern Michigan Edison Company. For the past two years this company has been making a concerted effort to build up its business in this division, and a special house-wiring campaign has been featured every spring and fall. Last year the Mount Clemens campaign included, in addition to very low rates for wiring, a drawing contest in which each customer having an old house wired received one chance on a sixty-five-dollar washing machine for every dollar or fraction thereof spent by him for wiring, fixtures and lamps. As a result of this campaign, in sixty days contracts were secured for the wiring of eighty old houses. At the end of 1914, by actual canvass, the town had reached a wiring saturation of 74 per cent. Of the remaining 26 per cent, about half were already piped for gas, and the remainder were rented houses or small cottages owned by day laborers.

This spring the company conducted another old-house-wiring campaign in Mount Clemens. The drawing cards of this campaign, in addition to the low wiring rate, are free energy for three months and a six-month period in which to pay for the wiring. Should a customer owning a rented house have that house wired, he then is given three months of free lighting as a premium. The house, however, must be rented; no free energy is given for the wiring of vacant property. This plan has resulted in placing about 50 per cent of the unwired rented houses on the company's lines.

An arrangement has been made with all local contractors whereby the company pays them a fixed price for each outlet wired, including switches. The contractor is paid for his work as soon as it is completed and has passed inspection. The customer pays the company in "easy payments" extending over six months' time. The contractors, it is said, are very well satisfied with this arrangement and make very satisfactory profits, besides their commission on material and fixtures.

During the first thirty days of this spring's campaign contracts were secured for the wiring of 102 houses, although the saturation as noted above was 74 per cent. In Armada, a neighboring village of about 750 population, two live salesmen recently secured thirty-two contracts in one day. This was more old houses than had been wired in Armada in the past three years.

In commenting on the campaign, the division manager states:

"The opportune offer of free electricity has in a great measure stimulated the wiring of old houses. While the offer on the face of it is not much in money value, it looks big to the class of people we are trying to interest and has several good talking points. Moreover, from the central-station standpoint, it does not cost much, as our only expense, except to the owners of rented houses, is the bare cost of energy. No meter is installed, and therefore there is no investment except for service wires and no overhead charges, such as reading the meter, billing, bookkeeping and collections. It also gets the customer into the habit of being liberal with the use of energy.

EASTERN MICHIGAN EDISON COMPANY
(ST. CLAIR DIVISION)
MT. CLEMENS, MICH.
(DETROIT, MONROE, MOUNT CLEMENS AND NEW BALTIMORE)

MT. CLEMENS, MICH., _____ 191__

DEAR SIR:

We hereby make proposal to furnish material and labor for electric wiring in your premises, No. _____ Street, for the sum of _____ Dollars ($_____)

Work to be first-class and to conform to the Board of Fire Underwriters insurance rules.

_____ Openings.

_____ Switches.

(Fixtures as listed on reverse side.) Yours truly,

EASTERN MICHIGAN EDISON CO.

Accepted _____

THE SIMPLE CONTRACT FORM USED

"We have no large cities in our territory and have taken advantage of the influence of neighborhood spirit as far as possible. We have worked on the plan that each employee has some friends and acquaintances who are not central-station customers, and have held weekly meetings, at which time a paper on some subject pertaining to the business is read. Afterward the campaign is discussed, and those present are encouraged to get out and interview their friends and, if possible, induce them to 'sign up' for house wiring if they own their houses, and, if not, to influence them to talk to the owner. A score-board is maintained with all the employees' names on it, and credit is given each for his jobs or for the 'prospects' he turns in who eventually 'sign up.' In the present campaign there are only three employees who are not credited with at least one house.

"I am of the firm opinion that not more than 10 per cent of the houses secured in these campaigns would have been wired unless some special offer, such as this one, had been made through a careful, thorough canvass of each non-user. Of course, we are very careful to see that all new houses are wired, and the only remaining prospects, therefore, are those people who believe the cost is too great or who are using some other method of illumination and are still ignorant of the advantages of electricity."

Railroad Safety Campaigns Offer New Sign Lighting Field

A new field for long-hour lighting business is afforded central stations in the electrically lighted "safety-first" signs erected by railroads to warn automobilists and

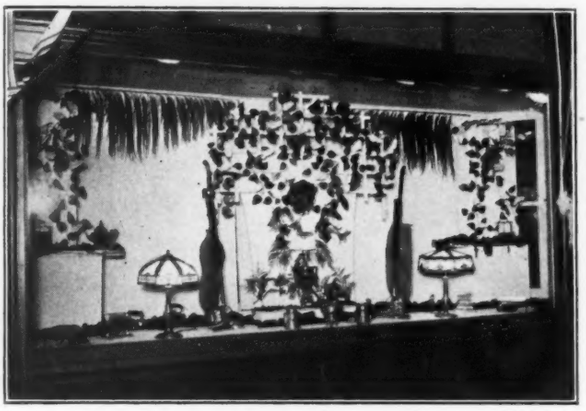
SAFETY-FIRST SIGN OF LONG ISLAND RAILROAD

others against careless crossing of their tracks. On the main thoroughfares of Long Island, for example, the automobile traffic is one continuous fast-moving procession. Owing to reckless driving, it has been impossible to prevent accidents at railroad crossings, even when these are protected with gates. The old "Stop, look and listen" signs fail to arouse any sense of impending danger. The Long Island Railroad Company has as a result inaugurated a strenuous safety-first campaign. In the accompanying illustration is shown one of the large new electrically lighted signs just erected by the company on one of its elevated crossings as a warning to automobilists against carelessness on reaching the grade crossings further on. The use of these signs is accompanied by periodical educational advertisements in the newspapers.

With the rapid growth of automobile traffic on the country roads of the United States many railroads will undoubtedly find such signs of much value, especially at night, for cautioning automobilists.

A Newspaper Contest to Advertise Well-Lighted Display Windows

In a novel "electric-lighted show-window" contest conducted recently by the Joplin (Mo.) *News-Herald* two entire pages were given over each Sunday to reproductions of photographs of the display windows of the leading merchants of the city. From these pictures all signs and other marks of identification had been removed, and to the persons who first guessed the names of the stores



THE EMPIRE DISTRICT ELECTRIC COMPANY'S OWN WINDOW WAS ENTERED IN THE CONTEST

whose windows were featured prizes of $5 and $3 respectively were offered. Three separate contests were held during three successive weeks, and during the fourth week the photographs were reprinted, this time showing the names of the firms.

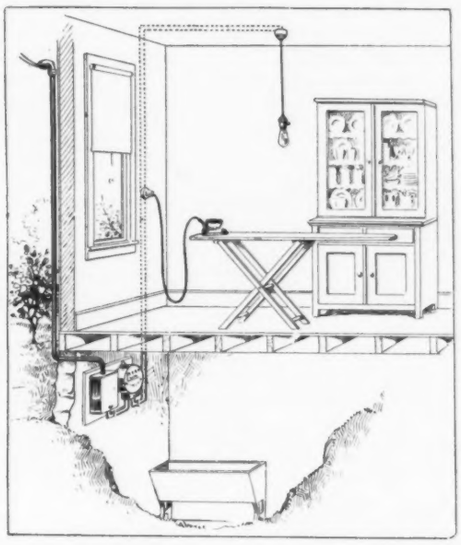
The merchants paid for their individual advertisements at the regular space rate. The Empire District Electric Company, which furnishes electric service in Joplin, defrayed the cost of the photographs, and the *News-Herald*, the paper in which the facts of the contest were published, supplied the cash prizes. The merchants who had a part in the contest all expressed themselves as well pleased with the advertising received, which reacted, of course, to help the electric-service company in further extending its campaign for well-lighted display windows.

Although the prizes offered were not large, explains Mr. R. J. Busey, new-business manager for the company, the novelty of the contest attracted and held the readers' interest and so secured considerable publicity for both the merchants and the electric company.

A JEWELER'S DISPLAY FEATURED IN THE JOPLIN WINDOW-GUESSING CONTEST

Salesmen's Ideas on Minimum Monthly Bills

One of the topics which proved of absorbing interest at the Columbus meeting of the salesmen of the Ohio Electric Light Association was the advisability of charging customers minimum monthly bills. Some favored abolishing all minimum charges, while others contended



THE DAYTON $10.98 KITCHEN SERVICE INSTALLED

that such a course would be ruinous, especially to companies in small towns.

Mr. H. C. Eddy of the American Gas & Electric Company, New York City, in opening the discussion said that many consumers in small towns use only 15 cents' worth of energy a month but are billed for a 75-cent minimum charge. Discovery of this state of affairs generally creates in the customer's mind resentment against a requirement by which he considers himself paying for something he does not get. If a company has enough of these small customers, it is only a question of time until the town's citizens are demanding in a body reduced rates and abolition of the minimum bill, and are even threatening municipal ownership. Mr. Eddy suggested therefore that all company executives analyze their customers' lists, determine how many customers are not using energy enough to equal their minimum charge, and set about gradually increasing the energy consumption of these customers by selling them appliances and larger lamps.

More Customers Since Discontinuation of Minimum Charge

Mr. Thomas F. Kelly of Dayton, in relating the experience of the Dayton Power & Light Company, said that since the company had abolished its 90-cent minimum charge the number of the company's customers had increased from 9000 to 12,000. The step taken in eliminating the minimum bill, said Mr. Kelly, materially aided the company's salesmen in adding these 3000 customers to the lines. The company's maximum rate is only 8.5 cents per kw.-hr., but in spite of this fact a kitchen-service campaign is under way to secure more small consumers.

In this campaign the company is offering to install two outlets in any kitchen and to furnish a 40-watt lamp and a 6-lb. iron for $10.98. The arrangement of a typical kitchen service is shown herewith. Such an installation, Mr. Kelly declared, is a permanent entering wedge for electric service. It is estimated that the annual revenue from such kitchen services, if no extensions are added, will be $8. The experience of the company indicates, however, that few patrons will be satisfied with any other illuminant after electricity has been tried in the kitchen. Abolishing the minimum bill has made it possible to solicit these small customers, it was declared.

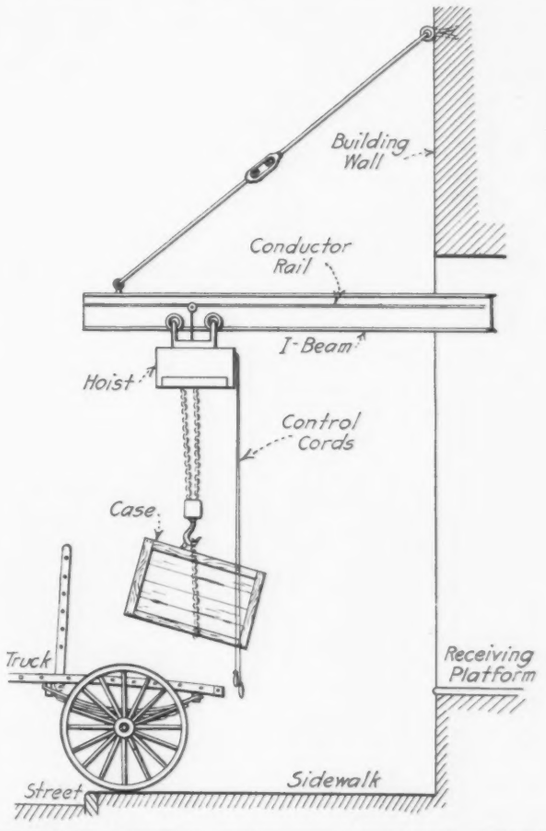
No Minimum Charges but Fewer "Low-Bill" Customers

Mr. G. W. Bixler of Akron, Ohio, commenting on the experience of the Northern Ohio Traction & Light Company, which operates without a minimum charge, said that in 1913 the company had 7000 customers, of whom 700 paid bills averaging less than 50 cents a month. In 1915 the company has 10,000 customers, and of these only 200 are paying the company less than 50 cents a month.

The secret of the company's success in reducing its number of small bills, said Mr. Bixler, will be found in the fact that the company consistently sells 1500 irons a year and is making a special effort to place irons with its "low-bill" customers. Electric irons, concluded Mr. Bixler, are the best devices to sell for this purpose, because they are inexpensive and when once purchased are used frequently.

Electric Crane Facilitates Unloading Wagons

To eliminate unnecessary handling of heavy boxes and packages between delivery wagons and receiving platforms a New York firm has recently installed an electrically operated traveling crane over the sidewalk where wagons are drawn up to unload. The crane rail consists of an I-beam extending perpendicularly from the building front and guyed with rods anchored in the wall. On this rail runs a small electric hoist supplied with energy from a conductor rail attached to the running rail and controlled from the sidewalk by two ropes suspended from the switch case which travels with the motor hoist. Instead of having to slide the packages off the trucks onto the sidewalk, with the consequent



SIDEWALK ELECTRIC CRANE FOR UNLOADING TRUCKS

danger of damaging the contents and then lifting the case to the receiving platform or vice versa, the hoisting chain is attached to the case or package which is raised off the wagon and transferred to the receiving platform, where it is deposited.

Making the Office Convenient for the Sales Staff

At the offices of the Worcester (Mass.) Electric Light Company additional space on an upper floor has recently been set aside for the use of the sales department. To obviate the inconvenience often arising from the lack of handy drafting facilities, home-made drawing tables (Fig. 1) have been provided at the rear of the power engineers' desks. Each of these tables is 42 in. long by 30 in. wide and is built of 0.75-in. stock. The tables are supported on brackets turning on vertical axes and are horizontally hinged so as to lie back flat against the wall when not in use. Since the preparation of mechanical sketches is an important preliminary to motor-service sales, this simple convenience has already proved itself very useful.

FIG. 1—DRAFTING BOARD AND TOOLS FOR THE SALESMAN WHO HAS MOTOR-INSTALLATION PLANS TO DRAW UP

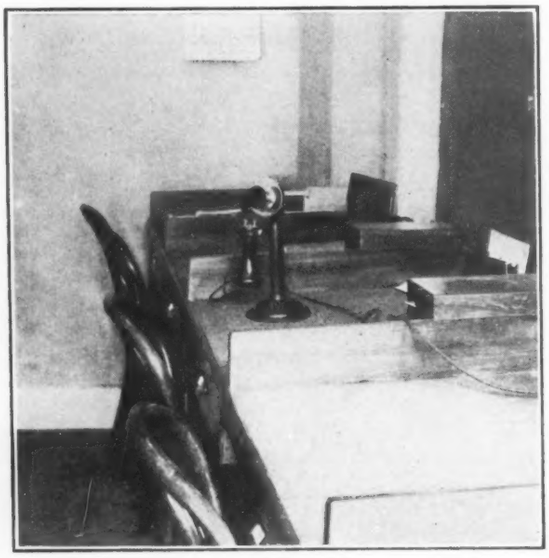
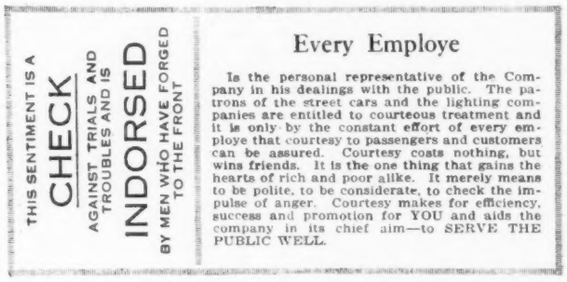


FIG. 2—INDIVIDUAL DESKS FOR LIGHTING SALESMEN

Less space is required for the lighting-service solicitors. These men occupy a separate office measuring 10 ft. by 16 ft. by 12 ft., and each man has a drawer and compartment in a table designed for this service (Fig. 2). The standard section measures 2 ft. 8 in. by 2 ft. 3 in. and is 2 ft. 7 in. above the floor. A telephone with a cord long enough to reach any of the six table sections is provided, and the room is purposely equipped with three different illuminating fixtures. One is a bowl reflector inclosing a 60-watt lamp; another is a 5-lamp fixture group with 40-watt units somewhat separated to enable the effect to be studied by customers, and the third is a bowl-type outfit inclosing a 100-watt nitrogen-filled lamp. A large map of the city is a convenient feature of the lighting department quarters.

Promoting Courtesy to Customers

To promote the display of courtesy by its employees, the Mahoning & Shenango Railway & Light Company of Youngstown, Ohio, recently attached to the pay checks of its men a printed slip, a copy of which is shown herewith, setting forth the company's policy of courteous treatment for its patrons. The distribution of these reminders by the company has been the cause of much favorable comment among the citizens of Youngstown, and the effect of the "courtesy campaign" is already evident in contributing to friendlier relations between corporation employees and public.


THIS SENTIMENT IS A
CHECK
AGAINST TRIALS AND TROUBLES AND IS
INDORSED
BY MEN WHO HAVE FORGED TO THE FRONT
Every Employe
Is the personal representative of the Company in his dealings with the public. The patrons of the street cars and the lighting companies are entitled to courteous treatment and it is only by the constant effort of every employe that courtesy to passengers and customers can be assured. Courtesy costs nothing, but wins friends. It is the one thing that gains the hearts of rich and poor alike. It merely means to be polite, to be considerate, to check the impulse of anger. Courtesy makes for efficiency, success and promotion for YOU and aids the company in its chief aim—to SERVE THE PUBLIC WELL.

A CHECK TO BE PLACED TO THE ACCOUNT OF COURTESY

The Gentle Art of Collecting Bills

"A good collector is a combination of nearly all the requirements which make a live business man," said Mr. George W. Hurn, office manager of the Haverhill Electric Company, Haverhill, Mass., in a recent address on modern methods of collecting outstanding accounts.

"He must be resourceful in methods, diplomatic, courteous and withal capable of drastic, kind, severe, generous, relentless or amiable moods; in fact, of every temperament that fits the particular requirements of the task in hand when he undertakes to separate the debtors from their money. A method that works well with one debtor may fall flat with another. A method that builds business through courtesy and kindness with one man may with another result in loss of money.

"Collecting is the art of educating customers to make prompt payments—not the collecting of accounts after they are due. If, therefore, we train our customers to pay their bills promptly, the results will be advantageous to both the customer and the concern, because if a customer can be educated to pay his bill within the discount period, he receives his service at the smaller cost and will be more satisfied than he would be if he had been hounded by notices and collectors."

NEW APPARATUS AND APPLIANCES

Portable Searchlamp

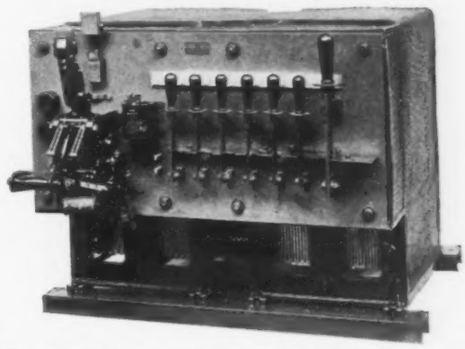
A powerful portable searchlamp operated from a storage battery has recently been developed by Thomas A. Edison, Inc., Orange, N. J., in co-operation with the General Electric Company, Schenectady, N. Y. Use is made of a 20-in. waterproof projector and a 35-volt, 750-watt focus-type nitrogen-filled lamp. The projector and battery are mounted on two wheels by means of trunnions so that the apparatus can easily be handled by one man. The outfit is approximately 5 ft. high, 3 ft. wide and 3 ft. long. It weighs 600 lb. and is designed to operate continuously for seven hours on one charge. The concentrated beam is sufficiently powerful, it is declared, to show objects half a mile away. By use

PORTABLE BATTERY-OPERATED SEARCHLAMP

of the adjustable focusing device, the light may be spread out in fan-shaped beam for close-range work. The equipment is designed particularly for city and factory fire departments; it is also well-adapted for night construction work, illumination of advertising, etc.

Multiple-Switch Starter

In the accompanying illustration is shown a multiple-switch starter for a 100-hp. direct-current motor consisting of a fool-proof switching apparatus which is interlocked with a circuit-breaker. In starting a motor controlled by such a "Witton" multiple-switch starter, as it is called, the circuit-breaker is first closed, and the switch which is employed to cut out the first step in the resistance is inserted. A locking bar is provided to prevent the insertion of either the switch which short-circuits the resistance or an intermediate switch on the starter. The bar is automatically moved along by the switches as they are successively closed and precludes the closing of any of the other switches out of their proper sequence. Further, should the circuit-breaker trip owing to an overload on the motor and an attempt be made to close it—which would mean short-circuiting the source of supply—a special trip coil on the circuit-breaker is provided which is energized through contacts which are short-circuited when any of the switches on the starter are closed. The action of the trip coil locks the circuit-breaker mechanism and prevents the circuit-breaker from being closed. The starter is being made by the General Electric Company,

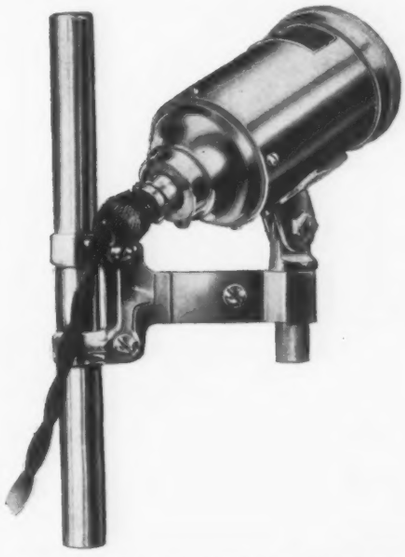


MULTIPLE-SWITCH STARTER FOR LARGE-SIZED DIRECT-CURRENT MOTORS

Ltd., of Great Britain, 67 Queen Victoria Street, London, E. C., England.

Automobile Searchlamp

A compact adjustable lamp designed for mounting on the windshields of automobiles is shown in the accompanying illustration. It operates at 6 volts and may be connected to the automobile lighting battery or may be employed with a dry-cell battery. Use is made of two high-power lenses and a tungsten lamp. The device is cylindrical in shape and measures 6 in. long by 2.25 in. in diameter. It is attached to the windshield by means of a universal joint which permits it to be turned in any direction desired. The lamp can be easily removed from the windshield and when detached may be



ADJUSTABLE AUTOMOBILE SEARCHLAMP

employed for inspection purposes. The manufacturer, the Pittsburgh Electric Specialties Company, Pittsburgh, Pa., points out that the lamp is well adapted for use by the car driver for reading sign boards and house numbers without moving from his seat. It also affords him a light for backing the car.

Electric Range

The Rutenber Electric Company of Logansport, Ind., is now marketing a light-weight electric range. As a distinctive feature of this stove, its manufacturers claim

LIGHT-WEIGHT ELECTRIC RANGE

that the heating units are arranged to secure unusually efficient transmission of heat to the cooking utensils. In the arrangement as worked out the entire heating coils are exposed to the utensils. It is also stated that the distribution of heat given off by the coils is the same at the medium temperature as at the high temperature. All metal parts of the range are of steel throughout, and the heating elements are easily removable.

Improved Guy Anchors

W. N. Matthews & Brother, Inc., 3722 Forest Park Boulevard, St. Louis, Mo., have recently inaugurated several improvements in their "Scrulix" guy anchors. Instead of casting the helix on the end of the guy rod as was formerly done, it is now threaded on, rolled threads being utilized. By this method it is practicable to cast six anchors at a time instead of the one possible with the old method. The rods of the 5-in., 6-in. and 7-in. anchors are of "Armco" iron, which is claimed to be very pure and practically rust-proof. The 8-in., 10-in. and 12-in. anchors are being made as heretofore, except that "Scrulix" and the size of the anchor are cast on the anchor; the rods are respectively 1.125 in., 1.25 in. and 1.5 in. square, and are of mild steel. The eyes of the 5-in., 6-in. and 7-in. anchors are screwed on to the rod and the size of the anchor is indicated on each eye, thus enabling an inspector to determine the size of the anchor when it is installed in the ground. The eyes are of malleable iron and are galvanized. The

FIG. 2—SHOWING MOLDS FOR CASTING SIX ANCHORS IN ONE BOX

galvanizing is done by a special process, the manufacturers point out, which does not affect the annealing. Rough castings of helixes are shown in Fig. 3.

Improved Flush Switches

A number of improvements have recently been made by the General Electric Company, Schenectady, N. Y., in the design of its flush switches. The corners of the porcelain boxes have been rounded, making the binding

FIGS. 1 AND 2—SINGLE-POLE AND DOUBLE-POLE FLUSH PUSH-BUTTON SWITCHES

screws more accessible and the boxes less liable to breakage when the switches are installed, and the walls of the boxes have been strengthened without increasing the over-all dimensions of the switches. A fiber dust cover

FIG. 1—METHOD OF CASTING THE ANCHORS

FIG. 3—ROUGH CASTINGS OF SCREW GUY ANCHORS

is now permanently attached, effectively closing all openings to the mechanism, it is declared, without interfering with the wiring of the switch. Adjusting nuts are provided with each switch. The holding-down screws are pointed, making it easier to locate holes in the outlet boxes and to enter the screws.

Socket Base and One-Piece Shadeholder

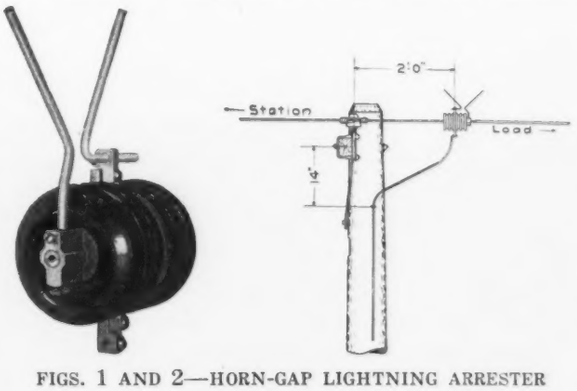
The socket base shown in Fig. 1 is designed for use with various types of the "Multipo" and "New Wrinkle" sockets made by the H. T. Paiste Company, Philadelphia, Pa., for which the Hart & Hegeman Manufacturing Company, Hartford, Conn., is the sole selling agent. The base is made to fit the opening of 10-amp. round-base "pipe taplets" of the single-opening type and of the gang types having two, three or four openings. In installing the socket bases, the switch bar and ring which are employed for fastening the switches are removed. When in position the base entirely covers the opening of the pipe taplets. No tap wires are required to fasten the socket bases to the main wires, the main wires being bared for ½ in. and slipped under the heads of the binding screws. Various types of key, keyless and pull-socket shells made by the above manufacturer are interchangeable with the base. The socket shells are also provided with a threaded bead so that they can be fitted with the "Uno" (one-piece) shadeholder which is shown in Fig. 2.

FIGS. 1 AND 2—SOCKET BASE AND SHADEHOLDER

Lightning Arrester

The horn-gap lightning arrester shown herewith, has been developed by Hubbard & Company, Pittsburgh, Pa., for use on either alternating-current or direct-current circuits operating at pressures varying from 500 volts to 13,200 volts. It consists essentially of a choke coil and a horn gap and is of such construction, the manufacturers point out, that repairs and cleaning are practically unnecessary.

The device is designated as a "Universal" lightning arrester and is mounted directly on the line wire as shown in Fig. 2, the wire passing through the choke coil, which is a 4-in. length of iron pipe clamped inside a porcelain insulating tube. The pipe has sufficient inductance, it is declared, to insure the discharge of the high-frequency static charges, but does not appreciably affect the line voltage. The arrester is clamped to the line wire by a split sleeve and two set screws. The grounded horn is held by a set screw in the upper end of one of the clamping bands; the gap at this point is adjusted by a gage provided with each arrester. The ground connection is inserted in a hole in the lower end of the other band and is held by a set screw. The insulator is made by the Locke Insulator Company, Victor, N. Y. The horns, bands, screws and clamps are made of brass to prevent corrosion while the choke coil is galvanized by the hot-dip process.



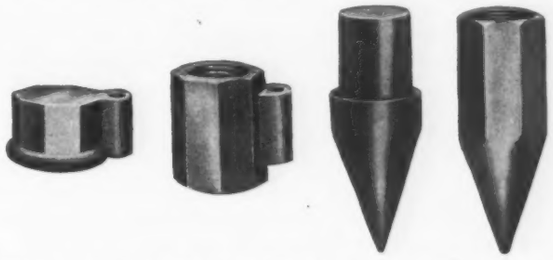
FIGS. 1 AND 2—HORN-GAP LIGHTNING ARRESTER

In installing the arrester, the horn-gap is adjusted with the gage; the line wire is cut, slipped through the arrester and spliced, and the ground wire is attached to the lower end of the clamp band. According to the manufacturers, the arrester is especially useful because of the fact that it limits the lightning discharge only to the section of the line affected and that it requires no cross-arm space.

Ground Fittings

Garton-Daniels ground fittings, as they are called, are being made by the Electric Service Supplies Company, Philadelphia, Pa., for both 0.75-in. and 1-in. pipe used with various sizes of wire and cable for grounding lightning arresters, pole and station apparatus, overhead ground wires, etc.

In Fig. 1 is shown a brass cap which is provided with a lug for soldering a ground wire to an arrester. Certain types of the cap are drilled for 0.25-in. cable and are largely employed for grounding overhead ground wires. Pipe couplings, which are included among the ground fittings made by the above company, are utilized for connecting two sections of ground pipe, an upper and lower section, employed in grounding the lightning arrester. The couplings are particularly useful where the ground pipe is extended 8 ft. to 10 ft. up the pole. The brass coupling illustrated in Fig. 2 is employed in grounding lightning arresters on electric railway systems, and is designed for use with either a wire or the free end of a stub-end terminal bond for connecting the lightning arrester to the rail. Brass couplings of the type shown are being made in both the 0.75-in. and 1-in. sizes.

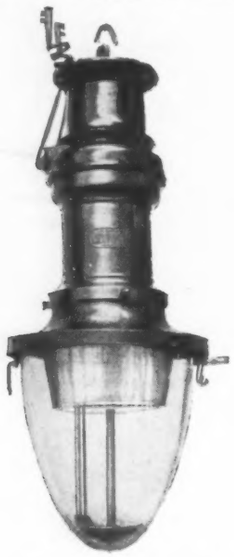


FIGS. 1, 2, 3 AND 4—BRASS CAP AND COUPLING AND MALLEABLE-IRON GROUND POINTS

The ground points shown in Figs. 3 and 4 are of malleable iron and are heavily galvanized. The ground point illustrated in Fig. 3 is of the internal type and is designed for use in soft ground, while that shown in Fig. 4, which is of the external type, is employed for driving in hard and rocky soil. The external-type points are of slightly greater diameter than the pipe, and in driving make a hole in the earth somewhat larger than that actually required by the pipe; much of the friction that would be offered by the pipe is, therefore, eliminated. After driving, it is declared, the ground quickly closes in around the pipe. The external diameter of the internal-type ground points is the same as that of the pipe.

Luminous-Arc Lamp with Refractor

Direct-current luminous-arc lamps equipped with refractors for residential districts have recently been developed by the General Electric Company, Schenectady, N. Y. In the accompanying illustration is shown



DIRECT-CURRENT SERIES LUMINOUS-ARC LAMP

a 4-amp. series lamp of the pendant type. The refractor type of lamp is well adapted for spacings of 300 ft. to 400 ft., the manufacturer asserts, giving an even illumination on the street surface.

Oil-Immersed Knife Switches

Oil switches designed for pressures up to 7500 volts have recently been developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The switches are non-automatic and are being made for indoor service in switchboard-mounting, direct-wall-mounting, and remote-control wall-mounting or pipe-mounting styles and for outdoor service for pole or subway mounting. The direct-wall-mounting type is particularly adaptable to motor installations, it is asserted, on account of the facility with which it may be mounted on any support convenient to the motor operator. The lever and handle extend outward over the oil tank so that the switch may readily be fastened against a wall, post or any vertical support.

With the remote-control wall-mounting or pipe-mounting styles the switch can be installed at a convenient point distant from the switchboard and operated from the switchboard or other point as desired. The outdoor-type O oil switch is well adapted for controlling lines where they enter buildings, branch feeders from the main lines, sectionalizing feeders, etc. The subway-type oil switch is designed for installing in subways, manholes and other places where it may be necessary to operate a switch submerged. The subway oil switch is made in two-pole, three-pole or four-pole single-throw and double-throw types for pressures up to 4500 volts and ratings up to 200 amp.

Characteristic features of the type D switches are pointed out as follows by the manufacturer: Knife-blade contacts submerged in oil; live parts carried on insulating supports affording permanent insulation between adjacent poles, and between the frame and live parts; small space required for mounting; accessibility of parts for inspection and repair, and inclosure of all live metal parts. Knife-blades are used since, it is claimed, they insure the best contact for low temperature rise in a non-automatic switch. To each contact jaw is attached an arcing piece which takes the final break, thus preventing burning of the jaws. The arcing pieces can readily be replaced when worn or burnt away.

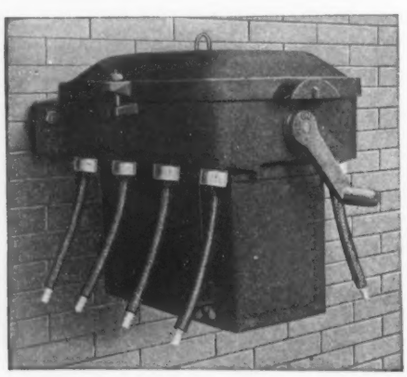
With the exception of the 1500-volt switches, the contacts are mounted on all-porcelain insulation. With switches for 7500 volts and above, the insulation is of the pillar-porcelain type. For the 4500-volt type with ratings up to 200 amp. the contacts are mounted on a horizontal porcelain base, with molded porcelain barriers between all live parts.

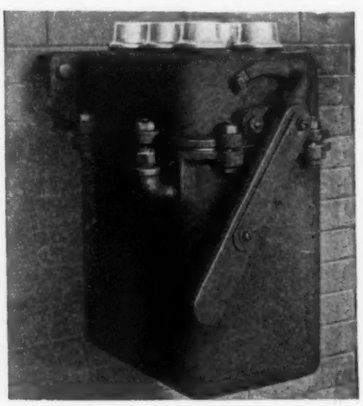
Porcelain Keyless Socket for Husk Installation

A porcelain keyless socket designed for insertion in a husk or covering, as shown in the accompanying illustration, is being made by Harvey Hubbell, Inc., Bridgeport, Conn. The socket is similar in design to the

PORCELAIN SOCKET FOR HUSK INSTALLATION

electrolier socket, and a special wrench is provided for attaching the metal cap to the husk. The manufacturer claims that wiring connections can be easily and quickly made because of the special design of the interior. The socket is equipped with metal caps having a ⅛-in., ¼-in. or ⅜-in. bushing.





FIGS. 1, 2 AND 3—4500-VOLT, 200-AMP. SWITCHES OF OUTDOOR TYPE FOR WALL OR POLE MOUNTING AND OF INDOOR TYPE FOR SWITCHBOARD MOUNTING AND SUBWAY INSTALLATIONS

CURRENT NEWS SECTION

General Electric Company Not to Manage International Steam Pump Company

Rumors have been circulated to the effect that one of the most important developments in the rehabilitation of the International Steam Pump Company will be the injection into the management of interests connected with the General Electric Company. Another earlier rumor stating that the General Electric Company had received a large order for munitions from one of the warring nations of Europe and that this would be turned over to the International Steam Pump Company only served to lend color to the likelihood of such an arrangement; Vice-president A. W. Burchard being mentioned as a probable director of the International Steam Pump Company. However, in an interview with a representative of the ELECTRICAL WORLD last Wednesday an official of the company denied most emphatically that the General Electric Company would participate in the management of the pump company. Later the following official statement was given out by the company:

"While the relations between the International Steam Pump Company and the General Electric Company have always been of the most friendly character, and it is expected that such relations will continue, their respective lines of manufactured product being complementary, but non-competitive, it is officially stated the General Electric Company will have no interest in the International Steam Pump Company under the proposed plan of reorganization, nor will it assume any responsibility whatever for its management."

Temporary Injunction Granted Springfield Company Against Missouri Commission

Judge Van Valkenburgh of the District Court of the United States for the Southern Division of the Western District of Missouri rendered last week the decision of Judges Sanborn, Pollock and himself in the suit for injunction brought by the Springfield Gas & Electric Company against the Missouri Public Service Commission. The court permits the company to install residence electric-lighting service at the rate it suggested, 10 cents, until the final adjudication, instead of at the 8-cent rate ordered by the commission and collected since July 1, 1914. The rate formerly was 15 cents. The court's comment on the methods of valuation on which the low rate was based pointed out that the lowest of three valuations was taken, reductions were made from this, and then an omnibus addition was put on for various specified items, whereas, for the guidance of later considerations, the value of each such item should have been stated. The court pointed out also that if all the items urged by the company for valuation, and disallowed by the commission, had been allowed, the income finally allowed would be too low; whereas it seemed that with these items disallowed, the income was high compared with other incomes permitted by the commission. The court suggested that there must have been something radically wrong with a system of computation by the commission, which could have resulted in this situation, and that certainly the company was entitled to a careful review of the case, and protection while the ultimate result pended. The court also took special note of the comment of the commission on the rates at Joplin, Mo.; if they were profitable, the commission urged, the rates should also be profitable in Springfield. The court suggested that conditions might be different in Springfield —and that anyway commission action based upon such an argument of comparative rates tended to override the right of control and management incidental to ownership. The court ordered that accounts be kept by which an adjustment might be made if the rate were ultimately lowered. In response to an objection of the commission's attorneys that the company, having a monopoly, would have the whip hand and be able, in case the new rates were declared illegal, to enforce collections of the previous loss by the present low rates, the court said: "It is a sufficient answer that the consumers are constantly changing, and that additional charges could scarcely be enforced against those who had not enjoyed the lower rate. Moreover, the powers of complainant are not so absolute as the suggestion of counsel would imply." The company would have to bring suits for its recovery. The court declared that the injury to the company would be great, certain and irreparable if its present motion were denied and its contentions finally sustained, while the inconvenience and loss to each consumer would be inconsiderable and might well be indemnified by a proper bond.

New York Compensation Law Valid

The Court of Appeals of New York, Judge Miller writing the opinion and all judges concurring, has decided that the Workmen's Compensation Law as signed by Governor Glynn is valid and constitutional; that it does not take away property without due process of law, and that it is not repugnant to any provision of the national or the State organic law. The decision was handed down July 13 and covered three questions raised in suits against the Southern Pacific Company and the Clyde Steamship Company.

Federal Trade Commission to Help American Business

A method for performing a "constructive service to American business," as well as machinery for enforcing the Federal Trade Commission act and the anti-trust laws, was outlined in a plan of organization formally adopted by the Commission on Tuesday.

Outlining the method by which the trade commission will be used as an agency to help business men, Commissioner Parry said that the division of corporation reports of the economic department appears to provide especially good facilities for service in this regard.

"It is the idea of the commission," Mr. Parry said, "that the division of corporation reports shall not merely gather and compile statistics, but that it shall classify the information it gathers and give it back to the world at frequent intervals in such manner and form that it will be helpful to industry.

"Among the activities of this division will be the securing of general facts regarding each industry and putting these facts into the hands of those interested. This will tend to prevent overproduction or the investment of new capital in an industry in which supply may have outrun demand. It will help business men to reduce cost of operation by standardizing products and by standardizing accounting systems.

"I believe," Mr. Parry added, "that the trade commission will become one of the great vital forces for the betterment of industrial and business conditions, and that its creation will be justified by the results derived therefrom."

In addition to the three departments outlined, there are three boards of review provided for, the economic board, the law board and the joint board of review.

The division of economic investigation will complete the unfinished investigations which were being conducted by the Bureau of Corporations before it was legislated out of existence. It will have charge of all investigations of charges filed against specific corporations; investigations made on the request of the Attorney-General to see if court decrees are properly carried out, or with respect to recommendations for the readjustment of the business of a corporation alleged to be violating the anti-trust act.

It is announced that no formal complaints against corporations will be given consideration until the return of the commission from its forthcoming western trip.

Hearings and Conferences

Close-range study of some of the more important problems with which the Federal Trade Commission will have to deal in the future is the purpose of the hearings and conferences which the commission will hold in several western cities, beginning July 19, in Chicago.

The meetings thus far definitely fixed are as follows: July 19 and 20, Chicago; July 21, Detroit; July 22, Cincinnati; July 23, Indianapolis; and the following six days, Chicago. Similar hearings probably will be held in Minneapolis, Tacoma, Spokane, Seattle, Portland, San Francisco, Los Angeles and San Diego.

While the commission will grant hearings along any lines within its jurisdiction, it is planned to devote attention particularly to the following program:

1. The commission will continue its conferences on foreign trade already begun in Boston and New York. Manufacturers, bankers, economists and others interested in promoting American commerce abroad will be invited to meet with the commission in conferences and will be asked to give suggestions and information as to the most effective means of building up trade in foreign markets.

2. Conferences will be held with trade organizations in various lines of industry. The first two days in Chicago will be devoted to a meeting with representatives of the National Association of Lumber Manufacturers. The purpose of these conferences is to enable the commission to obtain a broad survey of existing conditions in various large industries at first hand.

3. The commission will hold informal hearings in connection with informal complaints filed with the commission by various parties, alleging unfair methods of competition on the part of their competitors.

Cordial co-operation of business men and others interested in the work of the Federal Trade Commission already has been assured in all the cities the commission purposes visiting. Chambers of commerce, trade associations and individuals everywhere have manifested deep interest in the coming conferences, and it is hoped and expected that the future work of the commission will be greatly facilitated as a result of this tour.

Edison Heads Civilian Navy Advisory Board

The names of several distinguished American inventors have been suggested to Secretary Daniels for appointment to the Advisory Board of Inventors, which will be headed by Mr. Thomas A. Edison, and which is to co-operate with a Bureau of Invention and Development for the purpose of producing devices that will add to the efficiency of the navy in time of war. The Navy Department is not as yet prepared to announce the full details of the plan; these must be worked out in conference with the various bureaus.

In a statement Secretary Daniels said, "The country does not yet know the far-reaching and important experimental work done by Admirals Griffin, Strauss and Taylor, chiefs respectively of the Bureau of Ordnance, Construction and Repair, and Steam Engineering. They and their assistants have for months been studying every new development brought out by the war in Europe, and already they have contributed to increased naval efficiency. Additional experts will be given to them to carry on the development work they have been doing with ability and success.

THOMAS A. EDISON, CHAIRMAN OF NAVY ADVISORY COUNCIL

"The selection of the members of the advisory committee requires careful thought, but I hope to announce them shortly. In a broad way the underlying idea is to make available the inventive genius of our country to improve our navy.

"With Mr. Edison so willingly and cheerfully responding to my request, I feel sure that the advisory council, when the names are all selected, will be composed of men of such prominence as to make the country feel that what is possible for the human mind to devise will be devised for our navy.

"By the creation of this machinery no suggestion will be overlooked. Ideas impracticable in their details but which contain the germ of possible revolutionary improvement will be scrutinized both by our own naval experts and by men whose brains are peculiarly fitted for detecting possibilities in suggestions of this kind and who are particularly qualified for developing such germs of ideas into actual, practical things."

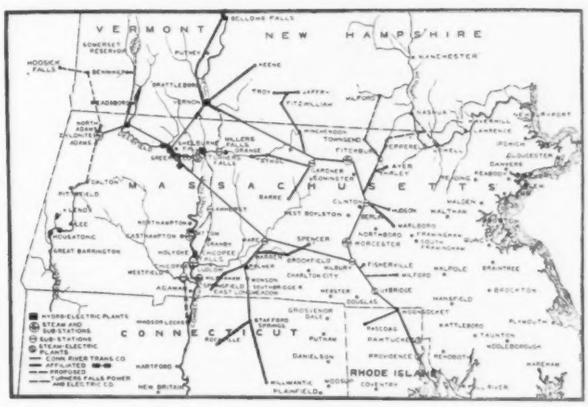
Although men like Dr. Charles P. Steinmetz, Hudson Maxim, Orville Wright, Lewis Nixon, Alexander Graham Bell, Peter Cooper Hewitt, John Hays Hammond, Jr., and John Brisben Walker have been mentioned as possible members of the civilian advisory board of inventors and technical experts, Mr. Edison is the only selection thus far announced.

Contractors Leave for National Convention

The majority of the New York contractors who will attend the annual convention of the National Electrical Contractors' Association in San Francisco, Cal., July 21-24 left New York, Saturday evening, July 10, on a special car over the New York Central Railroad. A number of prominent contractors also joined the party at Albany, Syracuse and Utica. Upon arrival in Chicago the party boarded the N. E. C. A. special train for San Francisco, stops being made at Grand Canyon, Arizona, Los Angeles and San Diego.

Report of Massachusetts Commission

The Massachusetts Gas and Electric Light Commission has issued its thirtieth annual report, covering the year ended June 30, 1914. The volume is one of the most exhaustive ever prepared by the commission and consists of over 700 pages of statistics, comments, reprints of decisions, and analyses of the operations of gas companies, electric companies, municipal plants, and other organizations under the jurisdiction of the



HYDROELECTRIC TRANSMISSION SYSTEMS OF MASSACHUSETTS

board. An appreciative tribute is included to the work of the late Forrest E. Barker, who was chairman of the commission for twenty years.

Returns for the year were received from eighty-six concerns supplying electricity and from thirty-seven municipalities engaged in this service. Last year was the first in which the commission exercised supervision over hydroelectric companies, and while no returns have yet been filed by such companies on account of the date of the act's effectiveness, a valuable summary of the principal features of the hydroelectric systems of the State, with a comprehensive map, is included. Under abatement of smoke, the report indicates that much improvement is being realized in the district covered by the board's inspectors. Last year there were 41,680 recorded observations, in 1334 of which an excess was noted in smoke emission, compared with 35,424 observations and 1225 excessive emissions in 1913. Eighty-five complaints were received, compared with ninety-six the year previous.

The income of the electric companies for the fiscal year was $16,771,413, compared with $15,128,212 in 1913. Dividends declared came to $3,503,404, against $3,418,538 in 1913; and the net profit for the year was $266,013 against $29,698 the year previous. Fifteen of the companies paid no dividends, but the others paid an average rate of 10.22 per cent. Twenty-one companies reduced their maximum net price during the year. A valuable feature of the report is an extended tabular statement showing briefly all action within the State in respect to the municipal ownership of gas or electric plants, and furnishing a historic summary of the subject of much interest. Another tabulation is a comprehensive detailed estimate of the cost of street lighting in each of the municipal plants of the State, with financial and physical data. The report also includes the names and addresses of the directors and principal officers of the companies.

FUTURE WORK OF N. E. L. A.

President Lloyd Outlines the Scope of the New Manufacturers' Section and the Advantages of Membership to Small Central Stations

Mr. E. W. Lloyd, general contract agent of the Commonwealth Edison Company of Chicago and the new president of the National Electric Light Association, has been in New York for a few days studying association affairs and conferring with a number of associates in the work of the organization. At the request of the ELECTRICAL WORLD, Mr. Lloyd discussed some of the work for the coming year.

Manufacturers' Section

President Lloyd regards the proposed Manufacturers' Section as one of the most important steps of the future. "The San Francisco convention," he said, "authorized the organization of this section upon formal application by ten manufacturers. We shall seek in every way to produce the harmonious co-operation which will make the section a permanent success. The idea is to give the section ample encouragement and opportunity to develop along lines which will best promote the interests of manufacturers and at the same time conserve and develop the welfare of the association and the industry as a whole. The Manufacturers' Section will be entitled to have three members on the association executive committee and will therefore be in close touch with all questions of policy and other important matters.

"The organization of the Manufacturers' Section will provide an agency through which all manufacturers, large and small, may co-operate in the great educational and development work of the N. E. L. A. Like the other sections it will be subject to general supervision by the executive committee of the main association. I feel sure that this supervision will be exercised with a sympathetic understanding of the problems of manufacturers and with an earnest desire to overcome them. Under present conditions, if we are to realize our highest possibilities of development, the thorough co-operation of all elements in the industry is essential. We hope to have the membership and official personnel of the Manufacturers' Section so representative that all classes will feel that they are having equal opportunities without regard to whether their interests are large or small. Members of the Manufacturers' Section will be eligible for service on all association committees and this will be a decided help both to manufacturers and central stations in the discussion of questions affecting design or improvements in apparatus.

"I believe that the N. E. L. A. is better adapted than any other agency to meet the needs of electrical apparatus manufacturers for organization. Central stations have a direct contact with the public that manufacturers themselves cannot easily get. Some of the manufacturers as well as some of the other active members do not fully realize that to a large extent the association is educational. I do not know that any of us appreciate its full possibilities as an educational medium. From the beginning it has been in the closest touch

with the art. It is equipped adequately to continue in touch with the progress in, for instance, high-tension distribution methods, steam turbines and the possible development of internal combustion engines. In the tests of concentric wiring, which are full of promising possibilities for the central-station industry if the system can be adapted with safety and economy to requirements in this country, the N. E. L. A. is thoroughly prepared to render excellent service."

In discussing the Manufacturers' Section Mr. Lloyd dwelt on the apparent tendency to sectionalize the N. E. L. A. activities. "The organization of a Technical Section to follow the Manufacturers' Section," he added, "would meet a need that is expressed by so many of our members that I am in favor of this step. Either the Technical Section, if formed, should be so inclusive as to provide satisfactorily for the hydroelectric interests or a separate Hydroelectric Section should also be formed in recognition of the largely increasing investment in that part of the industry. The Commercial Section and the Accounting Section, through their chairmen, Mr. Becker and Mr. Edwards respectively, have excellent plans in mind for the coming year."

Benefits of Membership

Mr. Lloyd said that he felt it to be his duty to urge member companies to participate to the widest extent in the benefits available to them as a result of the thorough organization of the industry. "The results which can be realized from membership of the great army of employees in the association and from their growing interest in its work and problems are so vast that they cannot be measured," he declared. "Think of the contact with the public which the daily regular work of all who are in the industry involves and of its potential power. The association is the direct representative of the great body of workers and they in turn are its representatives in direct dealings with the consuming public. It is very important that the association develop its educational work so as to render more service to the industry. It cannot give more than it can provide with the funds which it has, yet it can so standardize and centralize that the valuable service which it renders to one company is identically the same service which it can render advantageously to another company whose immediate pressing problem, gigantic though it looks, is the same with which the organization is in touch in another section of the country. Merely by giving advice on grave questions of policy, the association has been able frequently to save small companies many thousands of dollars. On the whole it is work of this character that is most important in the future of the association. Much of it has been done in the past and it is my hope that the association will be able to do much more in the future.

"The association is the agency to which the small companies should turn naturally when important matters affecting their revenues or properties arise. Not all of the officials of small properties are thoroughly familiar with present-day problems of policy. Nobody can deal more appropriately with questions of safety rules and public service commission matters than the N. E. L. A. We shall do all that lies in our power to help the small companies and in so doing we shall attract more of them to the membership. The association ought to have at least twice as many members as it has. The relation between the total employees of companies and their association memberships is now widely different in many cases, and one of the efforts during the coming year will be directly to lead companies that have a disproportionately small number of members to increase. Only in that way can the largest advantages of membership be realized."

ELECTRICAL OPPORTUNITIES IN BRAZIL

Electrical Installations and Conditions Prevailing in the State of Minas Geraes

By H. N. Douthitt*

Unlike some of the other states of Brazil, the State of Minas Geraes has many electrical installations. It has over sixty-five installations with a total capacity of more than 25,000 kw. Of these America has furnished seventeen installations with a total of 15,500 kw. Germany has thirty-six installations and 7300 kw., while England has less than 2000 kw. installed. The estimated value of the electrical machinery, including cost of erection, is about $10,000,000, of which the United States furnished about $6,500,000.

In some of the smaller cities of this State electrical energy has been more of a detriment than a help. Most of the plants are owned by the municipalities and the gross income on the cost is not sufficient to pay the interest. There are installations in Minas Geraes which cost over $150,000 where the average daily load will not exceed 60 kw. This, of course, is bad management and is one of the reasons why the State has not progressed electrically as rapidly as it should have done.

The old idea that hydraulic power is cheapest is disproved in a number of instances in this State. I can say safely that over one-half of the installations in Minas Geraes would be more economical if they were steam instead of hydraulic, as most of them are used exclusively for lighting and the wood supply will be sufficient and cheap enough to compete with water and the high cost of hydroelectric installations.

The city of Bello Horizonte, with a population of 25,000, is the capital of the State of Minas Geraes. It is a modern city, having been laid out in 1896. It has wide, well-paved streets, a street railway and lighting system, with many beautiful government buildings and several fine residence sections. Bello Horizonte first constructed the street railway and lighting system as a municipal experiment, and the city continued to manage them until 1912, when they were leased to Sampaio Correa & Cia. for fifty years at $88,000 a year. This company sold its interest to the Companhia Electric V. U. de Minas Geraes, which has reconstructed much of the system since and added several cars to the railroad equipment.

The first generating installation consisted of a hydroelectric plant of two 150-kw., two-phase Westinghouse generators, located 4 miles from the city. This was the second hydroelectric installation in Brazil. It was installed in 1900 and was in continuous operation until 1913, when it was shut down to be held as a reserve. These machines have been cited all over the country as examples of the superiority of American machinery, and have been of great assistance to American manufacturers in supplying over 60 per cent of the electrical equipment installed in the State. This is only a concrete instance of the value of actual advertising in South America, but it is likewise an example of the desirability of keeping up to a known standard because, if Americans now try to palm off second-class electrical machinery, the purchasers will know that they are being cheated.

Another hydroelectric installation was made in Rio dos Pedras, 24 miles from Bello Horizonte, in 1910-11. This installation consists of a dam 75 ft. high and 120 ft. long on the crest, constructed across a canyon where the banks are of solid granite. From the left side of the dam a canal leads to the forebay, from which three pipe lines drop to the power house 170 ft. below. They are laid in solid rock on an incline of 70 deg.

*Former Special Agent of the Department of Commerce.

The power house is a brick and stone building with three 600-kw., 2300-volt, three-phase, sixty-cycle G. E. generators installed. These are run by Morgan & Smith turbines and controlled by Lombard oil pressure governors. The voltage is stepped up to 45,000 volts through single-phase, oil-insulated, water-cooled transformers. All of the electrical equipment in the plant is from the General Electric Company. The transmission line is 24 miles long and was first constructed with wooden towers which cost more to build than steel towers would have involved. The line was rebuilt in 1913, and now consists of steel towers carrying two three-phase circuits and two telephone lines. A Siemans gas engine plant, consisting of two 380-kw. units, was installed in 1912 as a reserve.

Other large installations in the State are: The St. John del Ray Mining Company at Moro Velto, with 3630 kw. installed for use at the gold mine; the city of Barbacena, with 2200 kw. installed; Carangola, where the Cia. V. Luz e Forca Minas Geraes has a hydroelectric plant of 2000 kw., which furnishes energy to several small towns in that district and Palmyra, where the Cia. Brazil de Carbureto has an installation of 2880 kw., used to run its cotton mill.

Most of the hydroelectric installations are constructed by the firm which furnishes the material. All plans for installations furnishing energy to a municipality must be submitted to the State government for approval and be accompanied by a description of all the work, showing the estimated cost of each item. Labor is secured generally in the neighborhood of the works. Usually the company supplies the workmen with houses in which to sleep—the "house" consisting of poles set up close together and covered with thatch. The company also furnishes a cook who prepares meals, the men bringing a small kettle containing what they wish to have cooked for the day. Coffee is served early in the morning, breakfast from 10 to 11 o'clock and dinner from 5 to 6 o'clock. The food consists chiefly of beans, rice, meat and coffee, although the men eat many luxuries if they are obtainable nearby. Generally the company conducts a store where the men are allowed credit and where they will spend about 70 per cent of their wages for supplies, which are sold at a good profit. The best policy, however, is to provide supplies as cheaply as possible as an inducement to laborers to remain.

Wages vary in the different sections, but the average is as follows: Stone cutters and stone masons, $2.35 per day; mechanics, $2 to $3; carpenters, $1.65 to $2; linemen, $1.50 to $2; common labor, $1 to $1.50. I have found it to be good policy to offer to pay a little higher wages than are paid ordinarily in the district and to demand more work from the men. Many stone masons will lay from 1.5 to 2 cu. yd. of masonry per day, but in order to secure this much work it will require close attention to keep them supplied with mortar and stone. Bricklayers who can lay 800 bricks per day of ten hours are scarce. On most of the work the time is kept by the quarter of the day, but I found no difficulty in working the men by the hour, but it was necessary to post a sheet every day showing the time worked by each man, thus saving disputes on pay day. There are no labor organizations in Minas Geraes, and in case of a disagreement the men usually stand together for a day or two, but after that they are willing to return to work.

Very few new plants will be erected in the State during the next few years, as all the important towns have electric lights and it will be more difficult for the small towns to borrow from the State government. In the past it has been very easy for a town to borrow from the State at a low rate of interest when the money was to be expended for city improvements. Many of the towns have taken advantage of this opportunity and have constructed plants far in excess of their needs. Practically all of the machinery salesmen have been withdrawn from the State and credit has been refused to many who have been regarded in the past as good security.

As soon as business recovers from the present depression there will be a big demand for repair parts and many minor supplies. Credit should not be extended to any of the plants before some reliable information regarding their financial standing has been secured, as there are many plants which will not be able to meet expenses for several years to come, owing to the small demand for energy and the generally low rate for which it is sold.

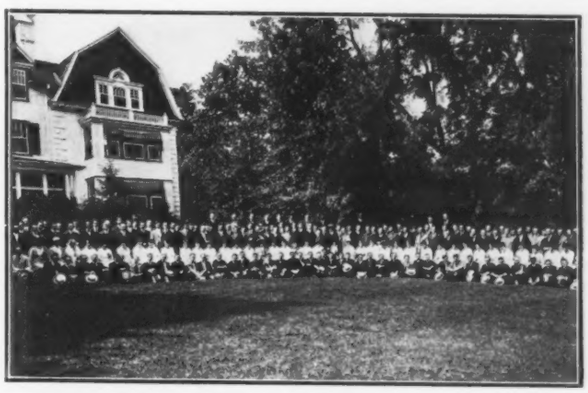
With the introduction of electric furnaces this State should become one of the leading iron-smelting districts of the world. There are many millions of tons of almost pure ore within easy reach of waterfalls which could be harnessed easily. Otherwise, owing to the lack of coal and poor transportation facilities, this iron ore will be of little value. With the benefit of American capital and American machinery, however, this almost undeveloped industry ought to receive a great impetus.

President of Storage Battery Company Entertains Employees

Lawn parties for employees' outings can scarcely be considered of sufficient importance to warrant more than passing mention in an engineering publication; but an event of this sort, which was rather unique, both in its inception and scope, should be of interest as evidencing the esprit de corps and cordial relationship existing between the head of a large manufacturing industry and his working force.

On June 26 Mr. Herbert Lloyd, president and general manager of The Electric Storage Battery Company, Philadelphia, invited the entire force of the general offices to a lawn party at his residence, "Bôd-Llyd," Bryn Mawr, Pa. This force included officers, department heads, stenographers and clerks—214 in all—who by means of a special train and a number of motor buses at Bryn Mawr Station were brought to Mr. Lloyd's suburban home.

The guests upon arrival were welcomed by Mr. and Mrs. Lloyd and treated to a round of games, races and



ELECTRIC STORAGE BATTERY EMPLOYEES AT BRYN MAWR

athletic contests which occupied the afternoon. Mr. Lloyd's string of polo ponies played an important part in several of these events. In the early evening a collation was served under the trees, at the conclusion of which the prizes were awarded to the winners of each event. Dancing on the green was in order until train time.

Miscellaneous News Notes

A Horse-drawn Hack with Electric Trimmings.—An enterprising hackman of Bath, Me., has provided his horse-drawn equipage with an electric-lighting outfit, including two headlamps on the front of the vehicle and a third lamp inside for the convenience of passengers. An electric bell and an electric automobile horn complete the equipment.

Exposition Load Boosts Output of San Diego Company.—During the first half of 1915 the electrical output of the San Diego (Cal.) Consolidated Gas & Electric Company showed an increase of 48 per cent as compared with the corresponding period of the previous year. A considerable part of the increased output has been due to the demands of the Panama-California Exposition.

Five Hundred Old Houses Wired in Ninety Days at Topeka, Kan.—Since April 1, more than 500 of the older residences of Topeka, Kan., have been wired for electricity, according to Mr. A. H. Purdy, general superintendent of the Topeka Edison Company. In addition, about 250 new houses have been wired for electric service, making a total of 750 new residence users of electricity during the last three months.

Suffragettes Enlist Telephone in Campaign for Votes.—July 25 has been set apart as Telephone Day by woman-suffrage workers, and on that date every loyal suffragette is asked to call up at least two doubtful voters and endeavor to win them to the cause. It is planned to make Telephone Day a nation-wide event and printed instructions are being prepared to enable the suffrage workers to compress the greatest substance of their arguments into the shortest use of the wire.

Demurrers Argued in Chicago Indictments.—Twenty attorneys for the 100 electric-fixture dealers and manufacturers and labor-union officials who were indicted by the Federal grand jury at Chicago last April, appeared before Judge Landis of the United States District Court at Chicago, July 8, to argue demurrers to the indictments. Attorneys W. M. McEwen, B. M. Smith, Julius Moses, F. F. Reed, and A. W. Bulkley were named by the lawyers to present the cases of the defendants.

War Conditions Increase Use of Electricity in Germany.—Although the blockade instituted about Germany by the Allies has practically cut off all importations of petroleum, nitrates, and other raw materials, the War Committee of German Industries reports that a substitute has been found for oil in the increased use of electric lighting, while nitrates made with the electric arc from atmospheric nitrogen have taken the place of imported saltpeter. The coal supply of the empire continues ample for all needs, it is declared.

To Make London's Curbstones Visible under Wartime Illumination.—According to reports from London some interesting experiments are to be carried out in that city to diminish the inconveniences of the reduced public lighting made necessary by the war and its resultant Zeppelin raids. Street curbstones, for example, are to be painted white, thus enabling the line of demarkation between roadway and pavement to be more readily distinguished by pedestrians and by drivers of vehicles. Householders are also to be asked to paint similarly all doorsteps leading from sidewalks.

Thirty New Submarines for U. S. Navy.—Reports from Washington indicate that the next Congress will be asked to appropriate funds for the building of at least thirty submarines, although some navy officers have recommended the construction of even fifty or seventy-five. In addition to the submarine's value as a means of offense against battleships and cruisers, the importance of the underwater boats for the protection of coast lines is now being recognized. All of the proposed new submarines, like those now in use by the United States and other navies of the world, will employ electric motors and storage batteries as the means of propulsion for running under water.

Electromagnetic Dentistry.—Some very odd uses have been found for the powerful electromagnets which now form the equipment of many industrial-plant hospitals. Although originally designed for removing metal particles from the eyes or flesh of workmen, one of these surgical electromagnets was recently applied to advantage in the case of a man who had attempted to drill his own tooth. The steel drill broke off in the tooth and remained in the cavity, and at first it appeared that extraction of the molar would be necessary. A special pole-piece extension was made and applied, however, and the broken drill immediately clicked into contact with the magnet and was drawn out.

Storm Damage in Cincinnati and Vicinity.—Considerable damage to electric lighting, telephone, and telegraph wires resulted from the heavy wind and rain storm which passed over Southern Ohio on the night of July 7. In Cincinnati, where several buildings were wrecked and others damaged, many wires were blown down, making the streets dangerous to traverse. Newport and Covington, Ky., Washington Courthouse, Chillicothe, and a number of other Ohio towns on the Ohio River above Cincinnati also suffered to some extent. Street and interurban railway traffic in Cincinnati and vicinity was tied up for several hours, while telephone and telegraph communication was possible over only a few lines until repairs could be effected.

Mayor Appoints Self City Electrician to End Deadlock.—Mayor T. S. Kearns of Waltham, Mass., appointed himself city electrician on July 6 to end the deadlock resulting from the refusal of the board of aldermen to confirm the mayor's appointment of Mr. W. J. Rooney to the position. Since the death of John T. Pownall, who had served the community for twenty-five years, Mr. A. J. Holbrook, formerly head electrician, had been acting as city electrician. Mayor Kearns meanwhile appointed Mr. Rooney, who was graduated from the Massachusetts Institute of Technology this year, but the aldermen refused to confirm the nomination and tabled the matter until their next meeting, set for Sept. 2. The mayor then named himself for the position.

Electric Supper Given by Great Western Power Company.—An electric supper and business meeting of its agents was held by the Great Western Power Company at the Hotel Washington, San Francisco, Cal., July 2, when every dish of the elaborate full-course meal was cooked electrically on special electric ranges in sight of the diners. Mr. Mortimer Fleishhacker, president of the company, arranged the event, Mr. Wallace Briggs presided as toastmaster, and Mr. Henry F. Holland delivered the principal address. A feature of the evening was the supper menu which was printed in the form of the purchasing agent's order sheet, with humorous use of the familiar business and technical terms of the company's purchasing routine.

Summer School of Scientific Management.—The Pennsylvania State College will conduct a summer school of scientific management during the two weeks beginning Aug. 9. This session is planned for the accommodation of works managers, superintendents, heads of cost, stores, purchasing, planning and production departments, and members of such departments. The time is restricted to two weeks to meet the needs of employees whose vacation period is limited to that time. The mornings of the session will be devoted to lectures and discussions on industrial organization and scientific management under the leadership of Prof. Hugo Diemer, and the afternoons to practice in applied methods of scientific management, in the making of time studies, tool lists, instruction cards, routing and scheduling under the direction of Mr. W. H. Tabor. Application for the course should be made at once to Director J. A. Moyer, State College, Pa.

Electric Pumping to Unwater Leadville's Flooded Mines.—Four 300-hp. motor-driven centrifugal pumps are being installed to unwater the Downtown mines at Leadville, Col., the rich deposits of which have long been inaccessible owing to the rise of water in the old workings and galleries. Each of the huge vertical-shaft pumps will deliver 1500 gal. of water per minute against a head of 430 ft. Last year negotiations had been closed with a Swiss company for the manufacture of pumps for the Leadville project, but the outbreak of the European war rendered delivery impossible and the order was finally placed with a Providence (R. I.) firm. Hon. Jesse F. McDonald, former Governor of Colorado, is at the head of the unwatering undertaking which is the first of its kind in the United States of such magnitude. Energy to operate the pumps will be furnished from the lines of the Central Colorado Power Company which enter Leadville at an altitude of 11,000 ft.

Associations and Societies

Georgia Electrical Contractors at Columbus, Ga.—The quarterly meeting of the Georgia Electrical Contractors' Association was held at the Ralston Hotel, Columbus, Ga., July 5, with Mr. H. E. Lawe of Macon presiding. At the close of the morning meeting a barbeque was given at Goat Rock in the visitors' honor.

Vicksburg Jovians Initiate Twenty.—At a Jovian rejuvenation held aboard the steamer J. H. Menge in the Mississippi River at Vicksburg, Miss., July 8, twenty novices were initiated into the Jovian Order. Among the guests of the evening were Congressman J. W. Collier, Mr. A. J. Bemis, Chicago; Mr. A. H. Jones, McComb City, Miss.; Mr. W. R. Herstein, Memphis, Tenn., and Mr. H. F. Wheeler, Hattiesburg, Miss.

Mississippi Convention Postponed Until November.—At a meeting of the executive committee of the Mississippi Electric Association held at Vicksburg, Miss., July 8, it was decided to postpone the annual convention of the association until some time in November, when the session will be called at Hattiesburg, as previously planned. Mr. R. B. Claggett of Greenville, acted as chairman of the executive committee in the absence of Mr. Charles M. Hays of Columbus, Miss., the president of the association.

Erie (Ohio) Jovians Hold Outing.—The annual outing of the Jovian League of Erie, Pa., was attended by about ninety local members of the order, besides guests from New Castle, Meadville, Youngstown and Corry. A special car carried the Jovians from the Reed House to the grounds at McDonald's Grove, east of the city. The feature of the afternoon was a ball game between the bachelors and the married men. Demonstrating their superiority in every department of the game, the married men carried off the contest by a score of 12 to 6. An excellent fish dinner was served at 6 o'clock.

Northern White Cedar Association's Frolic.—Leaving Minneapolis, Minn., June 25, a party of fifty-five, all members of the Northern White Cedar Association, journeyed by special car to Baudette, Minn., 450 miles north of Minneapolis, and there embarked on launches for their camp on Sabaskong Bay, Lake-of-the-Woods, 65 miles from Baudette. Three days were spent in hunting, fishing, and camp sports. Mr. N. E. Boucher, secretary of the association, is reported to have won the prize in the pea-shooting contest from Guide Riley, whose skill has long been famous among the Indians and whites of the upper lake country. Camp was broken June 29, after a memorable camp-fire "round-up" on the preceding evening and most of the party returned by boat to Baudette.

Texas Association to Continue Dallas Headquarters.—At the time of the Galveston convention of the Southwestern Electrical and Gas Association in May there was discussed the possibility of abolishing the association's central headquarters at Dallas, Tex., and the office of paid secretary, owing to business conditions in Texas and the advent of the "jitney" as a menace to street-railway earnings. At a subsequent meeting of the executive committee of the association at Dallas, June 25, however, a plan was approved by which the railway members of the association will, after Sept. 1, pay a reduced rate of assessment, while the central-station and waterworks members (whose business this year is better than ever) will contribute as before. To offset the resulting reduction in income, the association's energetic secretary, Mr. H. S. Cooper, has been granted the privilege of doing consulting and advisory work for members on his own account. Mr. Cooper was one of the founders of the association and is a past-president. He was formerly manager of the Galveston Electric Company and was in charge of the construction of the new Hotel Galvez at Galveston.

Missouri and Kansas Contractors Hold Joint Session.—Sixteen members of the Electrical Contractors' Association of Missouri met at the Hotel Kupper, Kansas City, Mo., July 10 with several members of the Kansas contractors' association, who were present to discuss the proposed consolidation of the two bodies. No definite action was taken, since it was pointed out that such combination would jeopardize representation of one or the other State association in the National Electrical Contractors' Association. The suggestion was made, however, that the Kansas association elect the same secretary as the Missouri body, and so secure for the Kansas work the services of Mr. A. J. Burns, who has helped to build that association. The subject of concentric wiring was discussed, pronounced opinions being expressed both for and against the innovation, and a committee was finally appointed to study the plan at first hand and to report observations and experiences. This committee consists of Messrs. Fred B. Adam, St. Louis; L. E. Reed, St. Joseph; J. W. Hutchison, Kansas City, and J. E. Bushong, Ottawa, Kan. The next meeting, scheduled for January, 1916, will be held at St. Louis.

Program of Ohio Convention at Cedar Point.—The program for the twenty-first annual convention of the Ohio Electric Light Association which is to be held at the Breakers Hotel, Cedar Point, Ohio, on July 20 to 23, has been announced as follows: Address of the president, Col. C. V. Hard of Wooster, Ohio; standing-committee reports, including the report of the illuminating committee presented by Mr. S. E. Doane of Cleveland; "Every-Day Problems Confronting the Central-Station Manager," by Mr. E. J. Bechtol of New York City; report of the transmission and distribution committee by Mr. M. H. Wagner of Dayton; "Salesmanship," by Mr. R. H. Grant of Dayton; "Snuggling up to John Smith," by Mr. E. Burt Fenton of Sandusky; report of the meter committee, by Mr. A. H. Bryant of Cleveland; "The World Do Move," by Hon. Beecher W. Waltermire, chairman of the Public Utilities Commission of Ohio; report of new business co-operations committee, by Mr. T. F. Kelly of Dayton; "Industrial Electric Heating," by Mr. H. O. Loebell of Toledo, and the report of the electric-vehicle committee, by Mr. C. W. Chappelle of Cleveland. In the advance program the announcement is made that the discussion of each of the foregoing papers will be opened by groups of men especially interested in the respective topics. Mr. D. L. Gaskill of Greenville, Ohio, is secretary of the association.

Public Service Commission News

Pennsylvania Commission

The Pennsylvania Public Service Commission has set Aug. 2 as the date on which the Philadelphia Electric Company must complete and file the inventory and appraisal of its property ordered by the commission. The commission has also announced that the hearings in the case affecting the rates charged by the company for lighting in Philadelphia will be resumed on Aug. 10.

Kansas Commission

The Supreme Court of Kansas has ruled that no public utility under the jurisdiction of the public utilities commission of Kansas can discontinue service without obtaining from the commission the authority to do so. The case was that in which the Postal Telegraph Company had closed its office at Syracuse, Kan., claiming that in operating this office the company was losing annually $135. The attorney for the utilities commission brought mandamus proceedings to compel the re-opening of the office, and the ruling was in favor of the commission.

District of Columbia Commission

The Public Utilities Commission of the District of Columbia has handed down a ruling which relieves public-service companies within the federal district from continuing to pay interest on deposits left with the company by customers after the closing of their accounts. The companies have agreed to place on all final bills a notice asking customers to call for their deposits, if one has been made.

In organizing its membership for work the commission has assigned to its members separate classes of subjects for consideration and special study. Major C. W. Kutz, the chairman, will have to do with matters of engineering valuation and rates. Cases relating to capitalization, jurisdiction, financial operations and court proceedings will be referred to Commissioner Brownlow. Service and accident cases are to be referred to Commissioner O. P. Newman.

California Commission

The California Commission has approved the rate in the contract in which the Consolidated Electric Company of San Francisco agrees to furnish electric energy to the Key Route system of the San Francisco-Oakland Terminal Railways at 0.95 cent per kw.-hr. This contract rate will displace on Aug. 1 the contract rate of 1.125 cents per kw-hr. heretofore charged the railways by the United Light & Power Company and which the commission had heretofore found to be unreasonable and excessive.

Ohio Commission

In a petition filed in the Ohio Supreme Court on July 7 by the Marysville Light Company, Marysville, Ohio, the allegation is made that the provision which gives the Public Utilities Commission the right to review a rate schedule when no referendum has been called, is in conflict with the initiative and referendum act and hence is null and void. The company asks for an injunction to prevent the commission from proceeding with the review. The company secured a lighting contract and the Marysville Council duly passed an ordinance incorporating the rates agreed upon. No referendum was called, but later on thirty-five citizens, or more than three per cent of the electors, petitioned the commission to review the rates and determine whether they are fair and reasonable.

The Columbus City Council has postponed action on the ordinance providing for an issue of $265,000 municipal lighting-plant extension bonds, as provided by a vote of the electors in 1912. The consensus of opinion is that a careful investigation of the lighting plant and the results of its operation should be made before any more money is spent in extensions. Some members of the council have expressed doubt as to whether the plant is paying its expenses of operation. It is said that the report which the city is having prepared in accordance with orders from the State Public Utilities Commission will show that the plant is paying operating expenses, interest on bonded indebtedness, ground rental and all other charges that would be placed against a privately-owned central station plant.

Indiana Commission

Nearing the close of the Indianapolis rate controversy, the Indiana commission has asked the heads of the two Indianapolis central-station companies, the Merchants' Heat & Light Company and the Indianapolis Light & Heat Company, to bring their rate experts together and to simplify, as far as possible the present schedules of rates, cutting down the number of schedules in force and simplifying the wording of the remainder. This, it is believed, will simplify the work of the commission in its final wording of the order establishing rates for electric service in Indianapolis. The problem of determining the most scientific method of computing charges for heating service in the homes and business buildings of consumers is another feature of the case which the commission has had to solve, but it is declared that there will be very little, if any, change in the heating rates in the forthcoming order by the commission.

Interest in the competitive telephone situation at Indianapolis has been revived by the announcement that the Central Union Telephone Company intends to construct a $20,000 Washington exchange in the north part of Indianapolis to replace a building in the outskirts. The attention of the public-service commission was immediately called to the fact that this announcement seemed to foreshadow a situation similar to that which occurred last year when the commission was forced to warn the Central Union and the Indianapolis Telephone companies that the commission would not permit rates based on further duplication of property in Indianapolis. The Indianapolis Telephone Company was then about to construct a new switchboard at a cost of approximately $500,000. The question of the merger of the two telephone properties arose about that time, and in a statement, Chairman Thomas Duncan of the commission, said that the decision of the commission on the questions of the merger and of rate-making must be postponed for at least a year and a half because of the press of business before the body. Members of the commission now declare they will investigate the building of the proposed new structure by the Central Union Company and will again warn the companies against duplication, pending the commission's action on the merger question.

Personal

Mr. John Barker has succeeded Mr. Herbert W. Thompson as purchasing agent for the Denver (Col.) Gas & Electric Light Company.

Mr. Alonzo R. Weed of Newton, Mass., has been appointed a member of the Massachusetts Gas and Electric Light Commission by Governor Walsh.

Mr. William Law has resigned as head of the electrical department of the New Bedford (Mass.) Industrial School to enter the electrical business locally.

Mr. J. V. Nichaus has been appointed resident manager of the Perry County Public Utilities Company at Perryville, Mo., to succeed Mr. George K. Miltonberger.

Mr. J. G. Strong has been appointed secretary and manager of the Marshall County Power & Light Company, of Blue Rapids, Kan., succeeding Mr. William Hunter.

Mr. Edward Nash Hurley, vice-chairman of the Federal Trade Commission, whose interesting suggestions concerning methods by which the newly instituted commission can be made of constructive help to American business, were sent broadcast last week, is well known as an electrical manufacturer and business man. He was born at Galesburg, Ill., July 31, 1864, and received his education in the public schools. Entering railroad work, he served as engineer for the Chicago, Burlington & Quincy Railroad until 1888 when he was appointed salesman for the United States Metallic Packing Company, of which he later became manager. Leaving this company in 1896 following his development of the pneumatic-tool industry, he organized the Standard Pneumatic Tool Company of Chicago, of which he was president and treasurer from 1896 to 1902. In the year last named, Mr. Hurley sold his interests in the Standard Pneumatic Tool Company and the International Pneumatic Tool Company of England, and thereafter engaged in farming and stock-raising at his country home at Wheaton, Ill., until 1908. In 1913 he was appointed United States Trade Commissioner to the Latin-American republics. As vice-president of the Illinois Manufacturers Association at that time and chairman of its foreign-trade committee, Mr. Hurley headed the movement which, in February, 1914, resulted in the cruise of American business men to South America. In December of the same year, Mr. Hurley was installed as president of the Illinois Manufacturers Association. Until his appointment as a member of the Federal Trade Commission the first of the present year, Mr. Hurley was president of the Hurley Machine Company, Chicago, manufacturer of electric washing machines, and had also other interests in the Independent Pneumatic Tool Company, and the Aurora (Ill.) Automatic Machine Company. He was also president of the First National Bank of Wheaton, Ill., and a director of the Chicago & Great Western Railroad. Mr. Hurley's appointment as vice-chairman of the Federal Trade Commission occurred shortly after the commission organized its members and staff to take up its new work.

E. N. HURLEY

Mr. John Morton, formerly vice-president of the Douglas (Wyo.) Electric Light Company, has been elected president of the company to succeed Mr. John T. Williams.

Mr. L. D. Shank has been appointed manager, contract agent and superintendent of the Centerville (Md.) municipal electric light plant to succeed Mr. Edgar B. Ward.

Mr. Wade G. Moores, who has had charge of commercial work for the Northern California Power Company, has been appointed manager for the Redding district of the company.

Mr. Gilbert Sheldon Smith of Philadelphia, Pa., has been appointed the representative of the Electrical Supply

Jobbers' Association on the Electrical Supply Manufacturers' committee on concentric wiring.

Mr. Ralph W. Hawkes has been appointed manager of the Old Orchard (Me.) office of the York County Power Company, succeeding Mr. Henry M. Burns. Mr. Hawkes was formerly connected with the Biddeford office of the company.

Mr. George F. Stoldt, who has been appointed superintendent of the municipal electric-lighting plant at Jacksonville, Ill., was formerly superintendent of the plant at Mount Olive, Ill. Mr. Stoldt succeeded Mr. William Catherwood at Jacksonville.

Mr. F. W. Ballard, lighting commissioner for the city of Cleveland, Ohio, has been retained by the city of Kalamazoo, Mich., as consulting engineer for the latter's new municipal plant. Mr. Ballard will continue his connection with the Cleveland plant.

Mr. Edwin Musser Herr, president of the Westinghouse Electric & Manufacturing Company, who, as noted in these columns, recently received the honorary degree of master of arts from Yale University, was graduated as a mechanical engineer from the Sheffield Scientific School of Yale with the class of 1884. Mr. Herr was born at Lancaster, Pa., May 3, 1860, and began his career as a telegraph messenger, later becoming an operator at Denver, Col., and then station master and operator at Deer Trail, Col., on the Union Pacific Railway. While in this service he prepared for college, and after graduation from Sheffield in 1884 he became a special apprentice of the Chicago, Milwaukee & St. Paul Railway in its motive-power department at West Milwaukee. Later he entered the motive-power department of the Chicago, Burlington & Quincy Railroad as mechanical draftsman and test engineer. As the result of his former experience he was finally made superintendent of telegraphs of the "Burlington" system, and his work in this department, especially during the Burlington strike, brought him to the attention of the operating department and led to his appointment as division superintendent of the Galesburg division of the line. In 1890 he went with the Chicago, Milwaukee & St. Paul Railroad as master mechanic, which position he held until 1892, when he was called to the superintendency of the Grant Locomotive Works at Chicago. In 1895 he was sent to Europe to report upon and to establish locomotive works in Russia. Upon the completion of this mission he became, in 1896, general manager of the Gibbs Electric Company, of Milwaukee, Wis., and shortly afterward accepted the position of assistant superintendent of the motive-power department of the Chicago & Northwestern Railroad. In 1897 he went to St. Paul as superintendent of the motive-power department of the Northern Pacific Railroad, which position he retained until 1899, when he went to Pittsburgh to take the position of assistant general manager of the Westinghouse Air Brake Company, later becoming general manager of that company. In 1905 he was appointed first vice-president of the Westinghouse Electric & Manufacturing Company, which position he occupied until his election as president in 1911.

E. M. HERR

Mr. Joseph Stewart has been appointed a director of the Morgan County Electric Light Company of Martinsville, Ind., which will supply electric service to communities in the vicinity of Martinsville. Mr. Stewart was formerly superintendent of the electric lighting plant at Tipton, Ind.

Mr. William G. Keith has been appointed by Mayor Thompson of Chicago to succeed Mr. Ray Palmer as commissioner of gas and electricity for the City of Chicago, the appointment to become effective Aug. 1. Mr. Keith has been employed as assistant electrician by the Chicago West Side Park Commission.

Mr. Joseph H. Conners of Lowell, Mass., has received from Governor Walsh of Massachusetts the pen used by the executive in signing the new State law requiring the registration of master electricians and electrical journeymen. The pen was presented to Mr. Conners in recognition of his efforts to secure the enactment of the measure.

Mr. Leon O. Tebbetts, president and general manager of the Readfield (Me.) Light & Power Company, has transferred his residence from Augusta, Me., to Waterville, Me., where he has acquired an interest in the insurance business of H. B. Crosby & Company. Mr. Tebbetts was formerly registrar of deeds for Kennebec County. With Mrs. Tebbetts he is now on a trip to the Pacific Coast.

Mr. F. C. Rose has been appointed general purchasing agent for W. S. Barstow & Company, 50 Pine Street, New York City, and will have charge of all purchases for the public service properties controlled by the Barstow corporation, located in the states of New York, New Jersey, Pennsylvania, Ohio, New Hampshire, Vermont, Indiana, and West Virginia. Mr. Rose was formerly general purchasing agent of the Foundations Company, Ltd., Montreal, Canada, and was at one time assistant general purchasing agent for the J. G. White Company of New York.

Mr. Irving M. Frost, director and general manager of the Rutland (Vt.) Railway, Light & Power Company and general manager of the Western Vermont Power & Light Company and the Pittsford Power Company, has sent his resignation to W. S. Barstow & Company, the corporate managers of these properties, the resignation to take effect Aug. 1. For a number of years he was manager of the Montpelier Traction Company, besides being manager and a member of the firm of Corry-Deavitt-Frost Electric Company, both of which companies are now under Tenney management. Mr. Frost has been manager of the Rutland company since May, 1912.

Mr. Henry L. Burnett has resigned as temporary manager of the electric lighting plant at Chicopee, Mass., and Mayor Dunn of Chicopee has appointed Messrs. Luke C. Meehan, Ulysses H. Roe and Charles W. Embury members of the board of lighting commissioners, succeeding the late board, which was deposed about two weeks ago. Mr. Meehan is the owner of an electrical contracting establishment in Chicopee, and has resided in the city for eight years. He installed the town's system of ornamental lighting and was also in charge of the installation of the local electric pumping equipment. Mr. Roe has been chief engineer of the Spalding plant at Chicopee for several years, and Mr. Embury is prominent in banking circles.

Obituary

James MacQuaid of Pittsburgh, Pa., one of the founders of the National Conduit Company, died of heart failure, July 10, in London, England. Mr. MacQuaid's death followed an illness of several months at his country home at Twickenham, which was once Pope's villa.

Hon. Pliny Norcross, who was drowned at Janesville, Wis., July 12, was at one time president of the old Northwestern Electrical Association in the early days of the electric-lighting industry. Later he became well known as the builder of a 33-mile transmission line near Janesville.

Basel D. Childers, secretary and treasurer of the Childers & Waters Electrical Company of Louisville, Ky., is dead after an illness lasting several years. Mr. Childers, who was 52 years of age, had never married. Three brothers survive him, Mr. C. C. Childers, president of the company, and Messrs. S. Y. and Henry H. Childers.

Charles F. S. Hance, superintendent of electric meters of the Pennsylvania Utilities Company, Easton, Pa., died recently at his home in Dover, N. J., following a physical and nervous breakdown. Mr. Hance was born in Dover thirty-nine years ago. He was graduated from the Dover High School and entered business as a clerk in that city. Later he entered the employ of the Dover Electric Light Company and was promoted through various positions until he had charge of the distribution system. When the Pennsylvania Utilities Company took over the Dover property Mr. Hance continued with it, finally being appointed superintendent of electric meters.

Corporate and Financial

Augusta (Ga.)-Aiken Railway & Electric Corporation.—The annual report of the company for the year ended Dec. 31, 1914, states that the operation of the new hydroelectric development of the Georgia-Carolina Power Company was taken over on July 1, 1914, and all electricity used by the system is now being generated by water power. This has resulted in a saving in the production cost in all departments of approximately $25,000 for the year. The total installed capacity of the power customers, including small motor installations, on Dec. 31, 1914, was 8413 hp., of which 4126 hp. was contracted for and connected up in 1914. The greater part of the business contracted for in 1914 was connected during the last five months of the year, so that only a small amount of the annual earnings from this new business appears in this year's statement. Contracts for nearly 1780 hp. additional have been closed during the first three months of this year. There still remains approximately one-half of the present power plant capacity to be sold. The revenue account follows:

	1914	1913
Gross earnings	$738,372	$725,073
Operating expenses, including taxes	393,886	403,084
Net earnings from operating	$344,486	$321,989
Less:		
Interest on Augusta Railway & Electric Company first mortgage 5 per cent bonds	$48,467	$50,000
Sinking fund Augusta Railway & Electric Company	6,540	5,000
Total prior deductions	$55,007	$55,000
Balance	$289,479	$266,989
Interest on 5 per cent sinking fund gold bonds	$150,366	$147,555
Interest on Georgia-Carolina Power Company first mortgage 5 per cent forty-year sinking fund gold bonds	68,750	.....
Interest on floating debt	8,839	2,615
Total deductions	$227,955	$150,170
Gross surplus	61,524	116,819
Dividends on preferred stock	45,000	90,000
Net surplus for year	$16,524	$26,819

Consolidated Electric Company, San Francisco, Cal.—The California Railroad Commission in a supplemental order approved the amended plan for reorganization of the United Light & Power Company and the sale of its properties to the Consolidated Electric Company. Under the original plan application was made for the Consolidated company to take over the properties of the United company and its subsidiaries, and for the Consolidated company to issue $10,000 in stock and $2,593,000 in bonds. The application also asked that the Great Western Power Company be granted authority to guarantee the bonds of the Consolidated company. The commission in its original order granted the application on the condition that the Great Western company's guarantee should be a firm guarantee and that the mortgage and deed of trust of the Consolidated company should provide for a sinking fund to begin in 1920 and to consist annually of 1 per cent of the bonds outstanding. Later the three companies modified their plans and applied to the commission, asking that the Consolidated company be authorized to take over the properties of the United company and its subsidiaries, and to issue $10,000 of stock and $2,318,000 of bonds, the bonds to be guaranteed by the Great Western company. In its supplemental order the commission approves the new plan on substantially the same conditions on which it approved the original plan. The commission's amended order requires that the mortgage and deed of trust securing the $2,318,000 of bonds of the Consolidated company shall provide for a sinking fund to begin in 1920 and to consist of 1 per cent annually of the bonds outstanding.

Interstate Electric Corporation, New York, N. Y.—An issue of $100,000 of first lien 6 per cent collateral sinking fund gold bonds due March 1, 1933, is being offered at a price to net about 6 per cent.

Lambertville (N. J.) Heat, Light & Power Company.—The Court of Chancery has authorized the public sale of the company on Aug. 2, 1915. The sale will be subject to a mortgage securing $80,000 of bonds.

Massillon (Ohio) Electric & Gas Company.—A block of $250,000 first mortgage 5 per cent sinking fund gold bonds due Jan. 1, 1948, is offered at 90 and interest to yield about 5.65 per cent. Earnings for the twelve months ended May 21, 1915, follow:

Gross earnings	$117,040
Operating expenses and taxes	70,352
Net earnings	$46,688
Bond interest	24,000
Balance applicable to dividends	$22,688

Northern States Power Company, Chicago, Ill.—The managers of the company announce they have been so well pleased with the results of the company's offering in June of 7 per cent preferred stock to citizens in communities served by the company that they have decided to continue the stock sales and to further develop plans to interest people of modest means and income. The plan met with favorable local reception and it will probably be made permanent. Before the plan was fairly started in a limited way approximately seventy-five new stockholders were recorded, the average taking being about four shares. The new preferred stockholders will receive checks mailed July 15 for the regular quarterly dividend of $1.75 per share earned during the three months ended June 30. Statistics relating to increased business so far as available show that the gains being made during the present year are even better than those of 1914, the net gain in connected electric load amounting to 6403 kw. for the first four months of the year, which is 56 per cent better than during the same months of the preceding year.

Ohio State Power Company, Fremont, Ohio.—The company has filed in the favor of the Cleveland Trust Company, trustee, a trust deed to secure $3,000,000 first mortgage 6 per cent gold bonds. The issuance of these bonds has been authorized to procure funds with which to build a steam station to supersede the present water power plant. The former company, the Sandusky River Power Company, found it to be impossible to make a water power development pay on account of the insufficiency of water at certain periods and therefore was forced to default on its bond interest. Mention is made in the trust deed of a twenty-five year contract to furnish energy to the Lake Shore Electric Railway Company and the Ohio Light & Power Company. Under this contract the two companies, in case of any default of the power company, may take over the operation of the plant for a period of two years to satisfy their power requirements. The two years will give the two companies sufficient time in which to procure some source of energy so that they will not in the meantime have to discontinue service. The rights of this contract come therefore before those of the bondholders. There were also filed two deeds showing the release of mortgages of $300,000 and $75,000 executed in May, 1913, by the Sandusky River Power Company.

Pacific Light & Power Corporation, Los Angeles, Cal.—The California Railroad Commission has issued an order extending the time within which the corporation may issue 19,430 shares of first preferred 6 per cent cumulative stock and $4,382,000 of first and refunding mortgage bonds from June 30, 1915, to June 30, 1916. Permission was given the corporation to issue these securities on Sept. 21, 1914.

San Joaquin Light & Power Corporation, Fresno, Cal.—The Railroad Commission of California has authorized the corporation to pledge as collateral security for $809,000 of promissory 8 per cent two-year notes to be issued for the payment of $954,000 of the company's two-year collateral trust notes due Aug. 1, 1915, $1,080,000 of its first and refunding mortgage forty-year Series "C" 6 per cent gold bonds.

Tulare Power Company, Lindsay, Cal.—To avert impending receivership at the hands of holders of its notes the company has brought before the Railroad Commission of California a tentative agreement between that concern and the Mount Whitney Light & Power Company, by which the properties of the former would be acquired by the latter. The Tulare company has outstanding $200,000 of notes, besides a floating debt of about $50,000, which it is unable to meet. Under the terms of the proposed sale the Mount Whitney company will acquire all the physical properties and franchises at a valuation of $550,000 and assume the note debt, paying to the retiring company $350,000 in cash.

Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.—A large majority of the convertible sinking fund 5 per cent gold bonds, due Jan. 1, 1931, having been deposited under the plan and agreement dated May 12, 1915, for the reduction of the price at which common stock of the company shall be issued upon the conversion of these bonds, and the elimination of the restrictive covenant contained in the Trust indenture of March 30, 1906, against the issue of stock by the company, the plan has been declared operative by Kuhn, Loeb & Company of New York, the managers. The company has extended the time within which the new convertible bonds provided for by the plan may be converted into common stock par for par from June 30, 1916, to Dec. 31, 1916; the privilege of conversion thereafter being, as provided in the plan, at the rate of $910 par value of such stock for each $1,000 bond. In accordance with the provision of the plan the company is about to offer to stockholders of record July 17 the privilege of subscribing, on or before Aug. 13, 1915, to the extent of 45 per cent of the par value of their respective holdings of stock, for the new convertible bonds. As soon as practicable after the expiration of the stockholder's subscription privilege, the company will notify depositing bondholders of the amount of cash or new bonds or both to which they will be entitled upon the consummation of the plan. Bondholders may still deposit their holdings subject to the termination of such privilege without notice. Stockholders taking advantage of the above offer must pay for each $1,000 bond $250 by Aug. 15, the remaining $820.83, which includes accrued interest, must be paid by Dec. 1. Up to the time of the meeting of the directors of the company July 7, out of a total of $19,445,000 of old bonds outstanding approximately $14,000,000 or 72 per cent had been deposited. All money received from stockholders' subscriptions will be used to retire the old bonds at 105. Those not retired in this manner will be converted into new bonds.

Manufacturing and Industrial

The Lindell Electric Company, 3704 North Grand Avenue, St. Louis, Mo., has recently taken over the electric supply and contracting business of the Devaney Electric Company.

Shapiro & Aronson, 20 Warren Street, New York, have appointed Mr. J. X. Nettor, for the past two and one-half years advertising manager for the New York Gas & Electric Appliance Company, as their advertising manager.

The Wm. C. Sterling & Son Company, Monroe, Mich., dealers in cedar poles, posts, ties, etc., with yards in Monroe and Bay City, Mich., have bought a large tract of land with 200 ft. of water front in Bay City, and will make the latter place its main distributing center.

The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has appointed the Barber-Dwinnell Electric & Manufacturing Company, Kansas City, Mo., as its district sales agent, assigning to it territory in the states of Kansas, Oklahoma, Nebraska and the Western part of Missouri.

Electric-Vehicle Companies Consolidate at Cleveland.—As was noted in the ELECTRICAL WORLD of June 12, the Baker Motor Vehicle Company and the Rauch & Lang Carriage Company, both of Cleveland, Ohio, have been merged. The Baker R. & L. Company is the name of the new concern.

The Mutual Electric & Machine Company of Wheeling, W. Va., manufacturer of switchboards, knife switches, electrical cabinets and electric starters for automobiles, which has leased a four-story building at Fort Street and Fourth Street, Detroit, Mich., as announced in the ELECTRICAL WORLD of July 3, will establish its principal offices and factory at Detroit.

Tent to Increase Storage-Battery Factory Facilities.—The Willard Storage Battery Company has installed a huge tent adjoining its plant at Cleveland, Ohio, in order to take care of its increasing business. The tent is utilized particularly for the testing and storage of large numbers of rubber jars. Ten new buildings are now in course of erection for the company.

National Metal Molding Company.—Mr. L. S. Montgomery has been appointed manager of the Buffalo (N. Y.) office of the National Metal Molding Company. From this office will be handled the company's business in western New York and in Canada. Mr. Montgomery was formerly connected with the National company's offices at Atlanta, Ga., and Pittsburgh, Pa.

Summer School at Westinghouse Works.—The annual banquet of the summer school of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., was held recently at Fort Pitt Hotel, Pittsburgh. Covers were laid for fifty. Mr. P. Smith was toastmaster and informal speeches were delivered by Bailey Whipple, James Lee, Robert Havey, and others.

The Syracuse Electric Fixture Company, 106 Seitz Building, Syracuse, N. Y., has been formed and is engaged in the repair and sale of lighting fixtures, heating devices, lamps, etc. Mr. W. P. Way is president of the company, Mr. G. R. Herriman is treasurer and Mr. E. E. Lavaute, secretary. The company is the agent for the Black & Boyd Company, L. Plout & Company and the Western Electric Company, all of New York.

Cool Weather Slackens Demand for Fans.—On account of the prevailing cool weather at Louisville, Ky., thus far during the present summer, it is reported that the business in electric fans there has been rather dull. The lack of "electric-fan weather" is also shown by the records of the Louisville Gas & Electric Company, which are said to record a decrease in energy consumption from that of other years, for certain sections, especially in the business district of the city, where fans are largely used.

Orders for Oil Engines.—The following orders have recently been received by August Mietz, 128 Mott Street, New York: Town of Charter Oak, Iowa, one 50-hp. engine and one 75-hp. engine for operating a small lighting plant; Baer Brothers, Stamford, Conn., one 160-hp. engine; Sexauer-Lemke, Astoria, L. I., two 100-hp. engines; T. B. Abell, Brooklyn, N. Y., one 25-hp. engine; Anton Hak, West Wellington, Conn., one 25-hp. engine, and J. F. Berndez & Company, Havana, Cuba, one 25-hp. engine and one 35-hp. engine.

Vacations with Pay for Employees of Fort Wayne Electric Works.—According to the ruling recently promulgated by the General Electric Company providing vacations on full pay to employees who have worked for the company ten years or longer, and who, as foremen or office employees are not now receiving vacations, some 111 employees of the Fort Wayne Electric Works of the company will be benefited. As a result more than 200 employees of the concern at Fort Wayne will this year have vacations on full pay.

Detroit Fuse Company Adding New Factory Building.—Contracts have been let and work started on a new $60,000 three-story concrete-and-steel addition to the plant of the Detroit Fuse & Manufacturing Company, 1400 Rivard Street, Detroit, Mich. The new building will have 35,000 sq. ft. of floor space which, with the floor area now available, will give a total of 60,000 sq. ft. The building represents the second addition made necessary by the company's increased business. The first building was erected in 1909 at 1400 Rivard Street, and the first addition was made in 1912.

Electric Fans for Hotels.—Sixty 9-in. oscillating fans made by the Emerson Electric Company, St. Louis, Mo., have recently been installed in the Langenfeld Hotel of Centralia, Mo., and fifty fans of the same type are now in service in the Hotel Pittenger, also of Centralia. Electric fans of Emerson make have also been installed in the Adolphus Hotel, Dallas, Tex.; the Maryland Hotel, St. Louis, Mo.; the Gay-Teague Hotel, Montgomery, Ala.; the Meyer Hotel, Nashville, Tenn., and the Seminole Hotel, Jacksonville, Fla. According to the manufacturer the idea of a fan for every room is becoming more and more popular with hotel managers in the central and southern sections of the country.

Orders for Twin Water Strainers.—A 42-in. twin water strainer is being built for the Toledo Railways & Light Company by the Elliott Company, Pittsburgh, Pa. This will be one of the largest twin strainers ever built, it is claimed, and will be, moreover, of special interest because of the motor-drive attachment, by means of which the valves are to be operated so as to direct the flow of water

through either compartment of the strainer. Because of the liability of the strainer being submerged for short periods during the flood seasons, the motor, together with its controlling apparatus, reduction gears, etc., will be suspended from the ceiling, the power being transmitted to the valves through vertical shafts, one for each of the two valve screws.

College Students Earn Money With Vacuum Cleaner.—The Y. M. C. A. at Purdue University recently purchased a Western Electric vacuum cleaner which is being loaned to deserving students who are earning their own support while in college. A letter has been sent to members of the University faculty announcing that the cleaner is available with an operator at thirty cents an hour. Twenty cents of this amount is paid to the student for his services in running the machine and the remaining ten cents goes to the Association for the maintenance of the equipment. The demand for the use of the machine has been steadily growing, it is declared, and if it continues at its present rate will necessitate the purchase of a second machine in the near future. The present cleaner is busy practically all of the time and earns about $20 a month for the students.

Sales of Graphic Instruments.—The Esterline Company of Indianapolis, Ind., has just closed a record-breaking month for graphic-meter sales. Some of the companies which have purchased instruments during the month of June are as follows: The Trumbull Electric Manufacturing Company, Plainville, Conn.; the Pennsylvania Railroad Company, Altoona, Pa.; the Public Service Commission of Indiana; the Martien Electric Company, Cleveland, Ohio; the Northern Electric Company, Toronto, Ont.; the Electric Machinery Company, Minneapolis, Minn.; the Edison Illuminating Company of Detroit, Mich.; the Philadelphia (Pa.) Electric Company; the Utah Power & Light Company, Salt Lake City, and the Des Moines (Ia.) Electric Company.

Structural Design and Foundation Engineering.—Mr. Joachim G. Giaver, who for the last seventeen years has been chief engineer of structural design and foundations for D. H. Burnham & Company, Chicago, announces that he has left the latter organization and has opened offices for the practice of consulting engineering at 751 Railway Exchange Building, Chicago, where he intends to specialize in structural design, foundations and building engineering in general. A graduate of the technical college at Trondjheim, Norway, Mr. Giaver came to America in 1882. One of his early jobs was the design of the iron supporting frame for the Statue of Liberty on Bedloe's Island, New York Harbor. As assistant chief engineer of the World's Columbian Exposition at Chicago, in 1892, he designed the three-hinge arch in the Manufacturers & Liberal Arts Building which remains the largest building arch in the world. A pioneer in the structural field, he introduced spandrel wind bracing in the modern steel-frame building and was the first to drive foundations to rock in Chicago, Milwaukee, Detroit and other Western cities. Mr. Giaver's latest skyscraper is the new 40-story Equitable Building in New York City.

NEW YORK METAL MARKET PRICES

	July 6 Selling Prices Bid	Asked	July 13 Selling Prices Bid	Asked
Copper	£ s d		£ s d	
London, standard spot*	79 15 0		78 5 0	
Prime Lake	19.75 to 20.00		19.62½ to 19.87½	
Electrolytic	19.50 to 19.75		19.37½ to 19.50	
Casting	18.25 to 18.50		18.12½ to 18.25	
Copper wire base	21.00 to 21.50†		21.00 to 21.50†	
Lead	5.75		5.75	
Nickel	50.00†		50.00†	
Sheet zinc, f.o.b. smelter	27.00†		27.00†	
Spelter, spot	22.00 to 22.50†		21.75 to 22.25†	
Straits tin	39.25		38.50	
Aluminum, 98 to 99 per cent.	32.00 to 33.00		32.00 to 33.00	

*OLD METALS

Heavy copper and wire	17.87⅞	17.87⅞
Brass, heavy	13.50	13.50
Brass, light	10.50	10.50
Lead, heavy	4.25	5.00
Zinc, scrap	17.00	16.00

*COPPER EXPORTS

Total tons to July 13	4,887

*From daily transactions on the New York Metal Exchange.
†Nominal.

New Incorporations

The New Hampton Electric Company of New Hampton, Mo., has been incorporated with a capital stock of $4,000 by C. A. Rowland, W. A. Denny and E. C. Morgan.

The Rinard Electric Light Company of Rinard, Ill., has been incorporated with a capital stock of $2,000 for the purpose of supplying electricity for lamps and motors. The incorporators are: A. R. Smith, F. M. Smith and A. J. Phillips.

The Morgan County Light & Power Company of Martinsville, Ind., has been granted a charter with a capital stock of $45,000 to supply electricity for lamps and motors. The incorporators are: J. H. Stewart, J. J. Albion and L. Lowenberg.

New Industrial Companies

The Kenohio Electric Company of Cleveland, Ohio, has been incorporated with a capital stock of $10,000 by William J. C. Kenyon, Floyd E. Waite, L. M. Sewell, E. G. Hoag, and Charles A. Colvin.

The Cleveland Sales Company of New York, N. Y., has been incorporated with a capital stock of $10,000 for the purpose of dealing in motors, dynamos, generators, machinery, etc. The incorporators are: M. Anton, N. N. Rulison, and J. O. Laino, 33 West Forty-second Street, New York, N. Y.

The Miller Centrifugal Motor Company of New York, N. Y., has been chartered with a capital stock of $600,000 for the purpose of manufacturing submarines, aeroplanes, torpedoes, motors, and electrical appliances. The incorporators are: E. Ullmann, M. Lippman, and E. L. Meyer, 108 West 141st Street, New York.

Trade Publications

Steel Screw Anchors.—Hubbard & Company, Pittsburgh, Pa., have issued a leaflet which contains information on their "Steel Wing" screw anchors.

Transformers.—The Packard Electric Company of Warren, Ohio, has issued Bulletin No. 206, which contains information on its secondary-voltage transformers.

Enameled Conduit.—The Sprague Electric Works of the General Electric Company, New York, have issued a folder which describes their "Spragueduct" enameled conduit.

Reflectors.—The Wheeler Reflector Company, 156 Pearl Street, Boston, Mass., is sending out a revised issue of bulletin R, which contains information on various types of reflector units.

Centrifugal Pumps.—"Centrifugal Pumps and Centrifugal Pumping Units" is the title of illustrated bulletin No. 1632 published by the Allis-Chalmers Manufacturing Company, Milwaukee, Wis.

Automatic Scale for Pulverized Coal.—The Richardson Scale Company, Passaic, N. J., has issued catalog No. 2215, which contains illustrations and information on automatic scales for pulverized coal.

Hundred-Watt Nitrogen-Filled Lamps.—The Edison Lamp Works of the General Electric Company have issued bulletin No. 3349, which contains information on their 100-watt nitrogen-filled Type B lamp.

Building Construction.—The Stone & Webster Corporation of Boston, Mass., has issued a profusely illustrated booklet showing some of the important structures recently erected under the company's direction.

Outdoor Disconnect Switch.—The Royal Electric Manufacturing Company of 556 East Fortieth Street, Chicago, has issued a bulletin describing and illustrating its new triple-pole disconnecting switch and other types of disconnecting switches.

Ground Detectors and Voltmeters.—Catalog 3001, Section DS 930, recently issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., contains information and illustrations on its Type TG electrostatic ground detectors and voltmeters.

Construction News

New England

TURNER, ME.—The Turner Lt. & Pwr. Co. is planning to extend its lighting service to Upper Street and North Parish.

LACONIA, N. H.—The contract for street-lighting has been awarded to the Laconia Gas & El. Lt. Co. for a period of ten years. It is expected under the new contract that the present arc lamps will be changed for 60-cp. lamps on the principal streets and 40-cp. lamps on streets in the residential section.

BARNET, VT.—Preparations are being made by D. L. Judkins, owner of the local electric-light plant, for the construction of a new power house on the bank of Stevens River.

SPRINGFIELD, MASS.—The officials of the New York, New Haven & Hartford Railroad are reported to be considering equipping the Tariffville and Midland divisions for electrical operation. The work will include the erection of overhead wires and power stations.

WEST NEWBURY, MASS.—The Newburyport Gas & El. Co. of Newburyport, has applied for permission to erect a transmission line from Pipestave Hill to the Groveland line.

LINCOLN, R. I. (post office Pawtucket).—The Town Council has granted the Connecticut River Pwr. Co., 50 Congress Street, Boston, Mass., a permit for the erection of a distributing station on Hazel Street. This station will have an output of 25,000 kw. which will be distributed in Pawtucket and Providence and other towns and cities in the Blackstone Valley.

WESTFIELD, R. I.—The Westerly Lt. & Pwr. Co. has practically completed its extension to Hope Valley, and has now commenced work on the extension of its lighting service to Alton, Wood River Junction, Carolina, Shannock and Kenyon.

BRISTOL, CONN.—The Bristol & Plainville Tramway Co. of Bristol, has awarded the contract for the installation of conduits on sections of Main, North Main and Prospect Streets and Riverside Avenue to the Fred T. Ley Co. of Springfield, Mass., at about $80,000.

Middle Atlantic

ALTMAR, N. Y.—The Pulaski El. Lt. Co. of Pulaski, a subsidiary of the Salmon River Co. will soon begin work on the extension of its transmission lines to Altmar. The taxpayers of the village have voted to appropriate $700 annually for street-lighting.

BINGHAMPTON, N. Y.—The City Council, it is reported, has readopted the ordinance authorizing an issue of municipal lighting bonds, passing it over the Mayor's veto.

CALLICOON, N. Y.—The Public Service Commission has approved the franchises granted to the Callicoon Independent El. Co. to supply electricity in Delaware and Callicoon.

CAPE VINCENT, N. Y.—At a special election held July 6 the proposal to sell the municipal electric-light plant and distributing system to the Northern New York Utilities, Inc., of Watertown, for $5,500 was carried. The village is to grant the company sufficient space to erect a transformer station (30 ft. by 30 ft.), which is to be ready for operation by Jan. 1, 1916. The company will be given a contract for lighting the streets of the village and for operating the pumping station. A 24-hr. service will also be established.

EAST WORCESTER, N. Y.—The Great Bear Lt. & Pwr. Co. of East Worcester, has applied to the Public Service Commission for authority to extend its electric transmission lines from East Worcester to the village of Worcester.

LA FARGEVILLE, N. Y.—The La Fargeville El. Lt. Co. has petitioned the Public Service Commission for permission to construct an electric-plant in the towns of Theresa and Orleans.

NEW YORK, N. Y.—Bids will be received by William Williams, commissioner of water supply, gas and electricity, Room 2342, Municipal Building, New York, until July 19, for furnishing cast-iron lamp posts with steel shafts. Plans and specifications may be obtained at the above office.

PERRY, N. Y.—The Public Service Commission has approved franchises granted to the Perry El. Lt. Co. to construct generating plants and to distribute electricity in Perry and Castile.

POMFRET, N. Y. (Not a post office).—The Town Board of Pomfret has granted the Niagara & Erie Pwr. Co. of Fredonia a franchise to supply electricity in Pomfret for a period of 30 years. The company proposes to extend its lines west to Portland and east to the Sheridan line, within a year, franchises having already been obtained in those towns, also to erect a line south to Laona. E. W. Newton of Newton is manager.

SKANEATELES, N. Y.—Plans are being prepared by the Village Board for the installation of an ornamental street-lighting system in Genesee and Jordan Streets in the business section.

BROWNSVILLE, PA.—The Borough Council has entered into a new contract with the West Penn El. Co. for a period of five years, under the terms of which the lamps now in use will be replaced with 400, 250 and 80-cp nitrogen lamps.

HARRISBURG, PA.—Application has been made to the Public Service Commission by the Conoquenessing Pwr. Co., of Conoquenessing, and the Lawrence Hydro-Electric Co. for approval of their charters.

HARRISBURG, PA.—The Public Service Commission has approved the following contracts: The Duquesne Lt. Co. of Pittsburgh, and the borough of Greentree, for installation of an electric street-lighting system; the Vandergrift El. Lt. & Pwr. Co. and the borough of Vandergrift for furnishing electricity for lamps and motors to the citizens of the borough; the Duquesne Lt. Co. of Pittsburgh, and the borough of Chalfant for furnishing electric street-lighting system; Edinboro Lt. & Pwr. Co. and the borough of Edinboro, for furnishing electricity for lamps, heaters and motors for commercial purposes.

MEDIA, PA.—The Borough Council has adopted an ordinance increasing the indebtedness by $70,000. The money will be used for improvements to the municipal electric-lighting plant and filtration system.

SCALP LEVEL, PA.—Application will soon be made for a charter for the Scalp Level El. Co., of Scalp Level, by Thomas Fisher, E. A. Delaney and B. L. Simpson. The company proposes to furnish electricity for lamps and motors in Scalp Level.

SHAMOKIN, PA.—Plans are being considered, it is reported, for the installation of an electric generating plant to supply electricity for the new high school building in Shamokin.

STONEBORO, PA.—The contract for electric wiring and installing electrical fixtures in the High School at Stoneboro, has been awarded to the G. A. Webster Co. of Youngstown.

BERNARDSVILLE, N. J.—The Eastern Pennsylvania Pwr. Co. of New Jersey expects to install within the next 30 days one 20-amp., three-phase automatic regulator in its substation at Bernardsville for the purpose of changing most of the distribution system to three phase, 2200 volts; also to purchase within the next 30 days 15 miles of No. 6 weatherproof wire, for use in connection with changing the present single-phase lines to three phase.

LAMBERTVILLE, N. J.—The property of the Lambertville Ht., Lt. & Pwr. Co. will be sold at receiver's sale on Aug. 5, at Lambertville. Charles D. McCracken is receiver.

PENNINGTON, N. J.—The Borough Council has ratified the contract with the Public Service El. Co. for lighting the streets of the village for a period of three years.

EASTON, MD.—The Public Service Commission has authorized the Easton Lt. & Fuel Co. to install additional equipment at its plant.

CHARLESTON, W. VA.—The Public Service Commission of West Virginia has ruled that all public service corporations in West Virginia furnishing gas, water or electricity must install a meter system throughout the State among their patrons on or before Jan. 1, 1916. All flat rates must be abolished before that date.

SHEPHERDSTOWN, W. VA.—A company (it is reported) is being organized to take over the property of the Sheperdstown El. Lt. & Pwr. Co. and to install a water works system in Shepardstown. A large electric power plant, it is understood, will be built on Potomac River at the mouth of Antietam Creek.

WELLSBURG, W. VA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington D. C., until Aug. 11 for construction, including mechanical equipment, lighting fixtures and approaches, of the United States post office at Wellsburg. Drawings and specifications may be obtained at the above office or from the custodian of site at Wellsburg.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 20 for furnishing at the various navy yards and naval stations the following supplies: Lake Denmark, N. J., Schedule 8549—4200 ft. stranded electric-light conductor. Brooklyn, N. Y., Schedule 8565—1600 copper covered Leyden jars; Schedule 8561—10,200 sounding tubes; Schedule 8562—60,000 ft. lighting and power wire. Boston, Mass., Schedule 8563—miscellaneous brass voice tubing. Washington, D. C., Schedule 8549—miscellaneous copper wire. Bids will also be received at the same place until Aug. 3 as follows: Washington, D. C., Schedule 8555—100 No. 3 deck clocks and 200 OD spy glasses; 8569—one 2000-lb. motor truck, 4000 lb. drawn brass tubing. Brooklyn, N. Y., Schedule 8557—17 electrically heated bacteriological incubators. New Orleans, La., Schedule 8566—four transformers. Norfolk, Va., Schedule—12 safety flanged valves. Applications for proposals should designate the schedule desired by number.

North Central

BURR OAK, MICH.—A new corporation, promoted by Chicago capitalists, it is reported, is being organized to take over five water power plants along the Fawn River and two on Pigeon River, and utilize the power to generate electricity for manufacturing purposes. A central station, it is said, will be erected at Mongo, Ind. E. B. Dill of Chicago, Ill., it is stated, is interested in the project.

COLDWATER, MICH.—The Board of Public Works is contemplating the purchase of a new 350-generating unit, consisting of a 350-kw. generator and engine. K. E. Norton is superintendent.

DECKERVILLE, MICH.—The Water and Light Department of Deckerville expects to purchase an 80 to 100-kva., three-phase, 60-cycle generator with exciter and engine, with necessary switchboard equipment; also some pipe and valves for installations. C. Adiel Sink is superintendent.

DETROIT, MICH.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 16, for the installation of an electric push-button dumb-waiter in the extension of United States post office and court house, Detroit, Mich. For details see proposal columns.

LAKEVIEW, MICH.—Within the next six months John J. Bale, owner of the local electric-light plant, expects to purchase 12 meters and about 2000 ft. No. 12 and No. 14 rubber-covered wire.

OWOSSO, MICH.—Plans are being considered by the Owosso Improvement Association for the installation of an ornamental street-lighting system.

ROSE CITY, MICH.—Within the next six months Messrs. Monaghan & Zailer, owners of the local electric-light plant, expect to purchase a waterwheel and some meters.

SANDUSKY, MICH.—The contract for construction of the new county court house at Sandusky has been awarded to the Covell Construction Co. of Ionia, at $74,528, which includes plumbing, heating and electric wiring.

VASSAR, MICH.—Within the next two months the electric light commission expects to purchase a few lamps. Walter A. Peck is superintendent of municipal electric-light plant.

CINCINNATI, OHIO.—A tract of fifteen acres, it is reported, has been acquired by the Tubular Producers & Steel Works of Pittsburgh, Pa., in Cincinnati, on which it will erect a large plant for the manufacture of steel tubing by an electric welding process. The company, it is understood, will install its own electric generating plant, which will have an output of 2000 kw.

CIRCLEVILLE, OHIO.—The Public Utilities Commission has authorized the Circleville Lt. & Pwr. Co. to issue $75,000 in bonds.

CLEVELAND, OHIO.—The Kessler Co. of Cleveland is reported to be contemplating the construction of a power house (45 ft. by 50 ft.) on Newberg Avenue.

CLEVELAND, OHIO.—Plans are being prepared by the Department of Public Service for extending the ornamental lighting system on Chestnut and Walnut Avenues between East Ninth and East Twelfth Streets.

CLEVELAND, OHIO.—Bids will be received at the office of commissioner of purchases and supplies, Room 511, City Hall, Cleveland, until July 23, for fibre conduit for the Municipal Electric Light Department. Specifications may be obtained at the office of the commissioner of light and heat division, 1443 East Third Street.

CLEVELAND, OHIO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 12 for furnishing and installing a conduit and wiring system and furnishing interior lighting fixtures in the United States marine hospital at Cleveland, Ohio. For details see proposal columns.

COLUMBUS, OHIO.—Bids will be received by B. L. Bargar, director of public safety, City Hall, Columbus, until July 20 for high-grade rubber-insulated, lead-covered telephone cable as follows: 1013 ft., carrying 50 twisted pairs; 3570 ft., carrying 15 twisted pairs; 15,562 ft., carrying 10 twisted pairs; 1475 ft., carrying 5 twisted pairs; 1000 ft., carrying 4 twisted pairs and 2000 ft., carrying two twisted pairs. Specifications are on file at the above office.

CUYAHOGA FALLS, OHIO.—Ernest McGeorge, engineer, 855 Leader News Building, Cleveland, it is reported, is asking for bids for the construction of a power plant for the Fall Rubber Co., 40 ft. by 60 ft., one story high. Plans for equipment, including engines and boilers, will soon be ready.

DILLONVALE, OHIO.—Bids will be received by the Council of Dillonvale at the office of the village clerk, until July 23 for furnishing electricity to light the streets, alleys and highways of Dillonvale, including lamps, poles and all appliances, for a period of five and ten years, in accordance with specifications on file in the office of Martin Campfield, village clerk.

FREMONT, OHIO.—The Council has signed a contract with the Ohio Lt. & Pwr. Co. of Fremont, to install 50 tungsten street lamps of 80 cp.

GREEN CAMP, OHIO—At a special election to be held July 17 the proposal to issue $5,000 in bonds for the installation of an electric-lighting system will be submitted to the voters.

LONDON, OHIO.—The installation of an ornamental street-lighting system (cluster lamps) is reported to be under consideration by the City Council.

ST. CLAIRSVILLE, OHIO.—As soon as connections are made with the transmission system of the Wheeling El. Co. of Wheeling, 40 new arc lamps will be purchased. A 24-hr. service, it is expected, will be established soon.

TROY, OHIO.—Plans prepared by C. F. Bowdle of Piqua, engineer, for the addition to the power plant in the court house in Troy (to cost $10,000), it is reported, have been accepted by the County Commissioners.

JENKINS, KY.—Arrangements, it is reported, have been completed for the installation of a municipal electric-light plant in Jenkins.

LANCASTER, KY.—The franchise of the local electric-light plant, owned by private parties, will expire in about two years. The city is contemplating taking over the plant to be operated by the municipality. Plans are also being considered by the Council to establish a day service.

SOMERSET, (KY.—Estimates of cost, it is reported, are being prepared for the installation of an ornamental lighting system on seven blocks. Fred Hunt is said to be interested in the project.

BLOOMINGTON, IND.—A committee has been appointed to make investigations relative to the installation of an ornamental lighting-system on South College Avenue. Ornamental standards carrying five-lamp clusters are under consideration. Dr. C. R. Harris is a member of the committee.

CONNERSVILLE, IND.—The Hydro-Electric Lt. & Pwr. Co. of Connersville has been awarded the contract for street-lighting, to begin Feb. 1, 1916, under the terms of which the company is to furnish 125 arc lamps, 25 series incandescent lamps of 25 cp and 118 nitrogen lamps of 100 cp. The company will install a complete new system, work on which is now in progress. W. E. Lowe is superintendent.

GREENFIELD, IND.—Foundations have been put in and arrangements made for the installation of a Skinner Universal, unaflow engine (19 by 20) directly connected to a 187½-kva. General Electric, two-phase alternating-current-generator with exciter, directly connected, at the municipal electric-light plant. E. C. Wolfe is superintendent.

HUNTINGTON, IND.—A committee has been appointed to investigate and decide upon the style of lamp standard to be used for the ornamental lighting system to be installed on Market and Jefferson Streets, to replace the arc lamps and arches now in use.

MARTINSVILLE, IND.—The Morgan County Lt. & Pwr. Co., recently organized with a capital stock of $45,000, is erecting transmission lines from Martinsville to Morgantown and Brooklyn, Ind., eleven and eight miles respectively. Electricity for operating the system in these towns will be supplied by the Martinsville Gas & El. Co. Contracts for street-lighting have also been secured and power contracts amounting to 350 kw. additional. Joseph H. Stewart is secretary and treasurer.

BUNKER HILL, ILL.—The electric light commission expects to purchase at once 3000 lb. 4/0 cable and will have the same amount of old copper for sale; it also expects to purchase considerable No. 00 to No. 8 wire. Charles E. Drew, chairman of commission, is purchasing agent and Ross McPherson is general snperintendent.

CARRIERS MILLS, ILL.—The Carriers Mills Utilities Co. expects to purchase within the next few months some transformers, poles, lightning arresters, insulators, wire, meters, rectifiers, incandescent lamps, etc.; also possibly some electrical appliances, including heating and cooking apparatus and household labor-saving devices. W. E. Taborn is secretary.

EDWARDSVILLE, ILL.—Bids will be received by the Madison County court house committee, at the office of Frank Troeckler, county auditor, Edwardsville, until July 20 for furnishing and installing new lighting fixtures in the Madison County court house at Edwardsville. Robert G. Kirsch, 4067 Magnolia Ave, St. Louis, Mo., is architect.

LA HARPE, ILL.—The La Harpe El. Lt. & Pwr. Co. has recently installed two boilers (16 ft. by 60 in.). A. L. Blythe is superintendent.

OREGON, ILL.—Plans are being considered for the installation of a new street-lighting system in Oregon.

RINARD, ILL.—The Rinard El. Co. was recently incorporated with a capital stock of $2,000 for the purpose of furnishing electricity for lamps, heaters and motors in Rinard. A. R. Smith is one of the incorporators.

FORT ATKINSON, WIS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 2, for construction, including mechanical equipment, lighting fixtures and approaches, of the United States post office at Fort Atkinson. Drawings and specifications may be obtained at the above office or from the custodian of site at Fort Atkinson.

PORTAGE, WIS.—The property of the Portage El. Lt. & Pwr. Co. has been purchased by Woodmansee & Davidson of Chicago, Ill. The price is said to be $145,000. Petitions are on file with the city clerk asking that a second election be held to vote on the proposal that the city purchase the plant.

CLOQUET, MINN.—The Cloquet Co. is erecting an electric transmission line from Cloquet to the power house at Forebay. The line will pass through the village of Thomasom, where the company will supply electrical service.

FAIRMONT, MINN.—The Water and Light Commission expects to purchase within the next two months about 100 lamp standards for the ornamental lighting system. Alfred Horne is superintendent.

FOLEY, MINN.—Within the next two months the Foley El. Lt. & Pwr. Co. expects to purchase material for line extension, consisting of poles, wire and general line material. H. E. Becker is president and general manager.

GOODHUE, MINN.—The installation of an electric-lighting system in Goodhue is under consideration.

HALLOCK, MINN.—The Council is reported to be considering submitting to the voters the proposal to issue $15,000 in bonds for the installation of an electric-lighting system.

MANKATO, MINN.—The Commonwealth Pwr. Co. of Mankato, is contemplating extension to its transmission system, which provides the erection of approximately 100 miles of three-phase, 60-cycle, 66,000-volt transmission line, running north and south in Blue Earth and Faribault Counties, Minnesota, and Kossuth County, Iowa, and building lateral branches therefrom to supply electrical service in the districts through which its lines pass. H. Merrifield is manager.

MELROSE, MINN.—Plans are being considered, it is reported, to install an electric-lighting system in Meire Grove, to cost about $2,500.

NEW RICHLAND, MINN.—The central garage and power plant has been reorganized and incorporated under the name of the El. Lt. & Pwr. Co. with an authorized capital stock of $25,000. The company expects to erect within the next three months a new power house (for which general contract has been let) and install a new generating unit and one boiler and equipment. Contracts for equipment have been placed. P. D. Breilein is vice-president and manager.

NORTHFIELD, MINN.—Upon the recommendation of the Consumers Pwr. Co. the Council has voted to replace the present magnetite arc lamps used in the ornamental lighting system with type C tungsten lamps and also to add a number of standards.

WALKER, MINN.—Within the next 30 days the Electric Light Commission expects to purchase one 60-hp Scotch marine boiler for the municipal electric plant. John E. Gray is superintendent.

WILLMAR, MINN.—Within the next 30 days the Board of Public Works expects to purchase one horizontal tube boiler (72 in. by 18 ft.). N. W. Larson is superintendent.

WINNEBAGO, MINN.—The Commonwealth Pwr. Co. of Mankato, which recently purchased the municipal electric distributing system, will install two substations, one outdoor and one indoor type, equipped with General Electric transformers, Garton-Daniels lightning arresters; overhead material required will include Northern cedar poles, 87 miles of No. 6 bare copper wire; Westinghouse meters (OA and C) will be used, and about 300 type C lamps. H. Marrifield of Mankato is engineer and manager.

CHARTER OAK, IOWA.—The City Council has selected a site on which the new municipal electric-light plant will be erected.

DICKENS, IOWA.—An election will be held July 19 to submit to the voters the proposal to issue $4,500 in bonds for the installation of an electric-lighting system.

HALFA, IOWA.—Bids will be received by Peter Tornell, president of Independent Consolidated School District of Halfa, until Aug. 13 for construction of a new high and grade school at Halfa, including general construction, heating and plumbing, electrical work and fixtures, manual training and domestic science and gymnasium equipment. Plans and specifications may be obtained at the office of Alban & Lockhart, architects, 347 Endicott Building, St. Paul, Minn., upon deposit of $10.

NEVADA, IOWA.—Within the next six months the Iowa Ry. & Lt. Co. of Nevada expects to erect a 13,200-volt, three-phase transmission line from Nevada to Colo, a distance of 8 miles; also to build a substation and distribution system in Colo, and to purchase material for above work. W. D. Cline is local manager.

PETERSON, IOWA.—The Peterson Pwr. & Milling Co. is planning to make improvements to its power plant this fall, but has not yet decided upon the new equipment. The company will also extend its electrical service to the towns of Royal and Everly. A. W. Jones is manager.

ROCK VALLEY, IOWA.—The Rock Valley El. Co. has recently installed one 125-hp. generating unit and has erected a transmission line to Alvord, and expects to complete within the next six weeks a line to Hull, Iowa. S. Thayer is manager.

STORM LAKE, IOWA.—The Storm Lake El. Lt. & Pwr. Co. is changing its complete distribution system from 110 volts, direct current to 2300/110 volts, three-phase, 60 cycles. Material has already been purchased. Frank W. Mack is superintendent.

KANSAS CITY, MO.—The Western Union Tel. Co. has been granted a revokable permit for laying in the downtown district a pneumatic tube service and conduits for carrying low-tension wires.

KEYTESVILLE, MO.—R. W. Cropper has engaged the Henrici, Kent & Lowry Engineering Co. Reserve Bank Building, Kansas City, Mo., to prepare plans and take charge of the engineering work for the construction of an electric-light plant in Keytesville. The equipment will consist of a 30-kva., three-phase, 60-cycle, 2300-volt generator driven by a gas engine, switchboard panel and series street lighting panel; overhead material for distributing system will require 210 poles and 97,000 ft. of wire; about 50 meters will be used to start with and about 50 series tungsten street lamps will be installed. Mr. Cropper will also build a plant in Bosworth, Mo., of about the same size. Not yet decided when contracts will be let.

SPRINGFIELD, MO.—Plans are being considered by the board of regents of the Fourth District Normal School for the construction of a power plant on the campus to furnish electricity for all the buildings. John J. Schneider is president.

WEBB CITY, MO.—Preparations are being made by the Empire District El. Co. of Joplin, for the erection of a substation on Guinn land near Webb City. The station will have an output of 4000 hp. Contracts have been placed for equipment.

WELLSVILLE, MO.—The city of Wellsville has purchased the property of the Wellsville Lt., Pwr. & Wtr. Co., to be owned and operated by the municipality.

GACKLE, N. D.—Plans are being considered for the installation of an electric-lighting system in Gackle.

MINOT, N. D.—The Consumers' Pwr. Co. of Minot, it is reported, is contemplating improvements to its system here, involving an expenditure of $75,000. The work will include enlarging and remodeling power house, installing additional boilers, engines and other machinery.

SIOUX FALLS, S. D.—Bids will be received by the city of Sioux Falls until July 26 for construction of a 1,200,000-gal. reinforced concrete covered reservoir; a 350,000-gal. elevated tank. Alternative bids will be received for pumping machinery as follows: Either one 5,000,000-gal. vertical triple expansion steam pumping engine, or two units each, consisting of an oil engine operating a 40-kw. generator and a 1500-gal. per minute vertical pump. Plans and specifications may be examined at the office of John Mundt, commissioner of water works and sewerage, City Hall, Sioux Falls, or at the office of Dabney H. Maury, consulting engineer, 1138 Monadnock Block, Chicago, Ill.

YANKTON, S. D.—The installation of a municipal electric-lighting plant in Yankton is reported to be under consideration.

AINSWORTH, NEB.—The Ainsworth Lt. & Pwr. Co. has submitted proposals to the towns of Johnstown and Woodlake offering to supply electricity in those towns. It proposes that the towns organize and erect their own lines to connect with the plant of the company in Ainsworth. The project includes furnishing electrical service to farmers along the line.

COLUMBUS, NEB.—The promoters of the new electric light company, it is reported, has submitted a proposal to the City Council offering to furnish electricity for lighting the city and to private consumers at the schedule the Council offered the Columbus Lt., Ht. & Pwr. Co.

DONIPHAN, NEB.—The Grand Island El. Co. of Grand Island is reported to be negotiating for the purchase of the property of the Doniphan El. Lt. & Pwr. Co.

LINCOLN, NEB.—Contracts have been awarded by the Board of Control for the installation of a new power plant in the State Penitentiary, to cost about $25,000. The equipment will include three boilers of 250 hp. each, three engines and 1200-kw. generators. Pole lines will be extended to the State Hospital and it is proposed to supply electricity from the plant to all the State institutions in Lincoln, and also to the State House and the Governor's Mansion.

SEWARD, NEB.—The Blue River Pwr. Co. of Seward, has submitted a proposal to the commissioners of David City to supply electricity to operate the municipal electric-lighting system there.

CANTON, KAN.—The contract for one 30-hp. and one 40-hp. St. Mary's oil engine, one 25-kva., 2300-volt generator and switchboard has been awarded to the Challenge Co., 1404 West Eleventh Street, Kansas City, Mo. This machinery will be installed in the new power house of the municipal electric-light plant. Part of the equipment of the old plant will be installed in the new building. W. D. Moore is superintendent of light and water department.

COUNCIL GROVE, KAN.—Within the next three months the Council Grove Ice, Lt. & Pwr. Co. expects to erect 3½ miles of 2300-volt transmission line. G. W. Harlan is president.

HIGHLAND, KAN.—A proposition is under consideration to erect a transmission line from Highland to Hiawatha (14 miles long) and purchase electricity from the Hiawatha Lt. & Pwr. Co. If the line is built the local plant, which is owned by W. V. Warner, would be closed down.

ROBINSON, KAN.—Bonds to the amount of $10,000 have been voted for the installation of a municipal electric-light and power plant in Robinson.

TOPEKA, KAN.—Extensions and improvements to the municipal electric-lighting system this year include the installation of a 500-kw. turbo-generator set (to operate condensing) and the erection of 100 ornamental lamp standards and 75 type C tungsten lamps of 400 cp. E. G. Stahl is superintendent.

Southern States

SALISBURY, N. C.—Work will begin at once on the erection of a steel tower electric transmission line from Salisbury to Statesville for the Southern Pwr. Co. It is understood that the company will rebuild the line between Salisbury and Charlotte (replacing the wooden poles with steel towers) as soon as the line to Statesville is completed.

ORANGEBURG, S. C.—Bonds to the amount of $15,000 have been voted for improvements to the municipal electric-light plant.

MEMPHIS, TENN.—The City Commissioners have adopted a resolution to exercise its option to take over the plant of Merchants' Pwr. Co. on Jan. 1, 1916.

NEW DECATUR, ALA.—The Alabama Pwr. Co., it is reported, is contemplating extensions to its local system. T. L. Beauchamp is local manager.

WEST BLOCTON, ALA.—The Alabama Pwr. Co. of Birmingham has applied to the Town Council for a franchise to supply electricity for lamps and motors in West Blocton. The company also asks for a contract for lighting the streets of the town for a period of ten years. E. M. Bishop is town clerk.

ABERDEEN, MISS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 11, for a heating system in the United States post office, court house, etc., at Aberdeen. For details see proposal columns.

OZARK, ARK.—The local electric-light plant is reported to have been purchased by M. B. Morgan of Morrillton, for $6,500. The new owner, it is said, is contemplating improvements to the property.

KAPLAN, LA.—The installation of a municipal electric-lighting plant in Kaplan is reported to be under consideration.

BLACKWELL, OKLA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 19 for construction, including mechanical equipment, lighting fixtures and approaches, of the United States post office at Blackwell, Okla. Drawings and specifications may be obtained at the above office or from the custodian of site at Blackwell, Okla.

BROMIDE, OKLA.—The installation of a municipal electric-light plant and water-works system in Bromide is under consideration.

EL RENO, OKLA.—The El Reno Gas & El. Co. is contemplating extending its transmission line to supply electricity to the Cheyenne and Arrapahoe Indian Agency, the El Reno Brick Co., Rock Island pumping station and Fort Remount station.

KAW, OKLA.—Preparations are being made for the installation of a municipal electric-lighting plant in Kaw.

SAN ANTONIO, TEX.—Plans are being considered by Commissioner Lambert for utilizing the water of the San Antonio River as it passes through Brackenridge Park to generate electricity to light the park.

Pacific States

BREMERTON, WASH.—The Bremerton-Charleston Lt. & Fuel Co. of Bremerton, it is reported, has applied to the County Commissioners for authority to erect and maintain electric transmission lines along the county road highways and streets on Bainbridge Island.

CHEHALIS, WASH.—Application has been made to the City Commission by H. G. Fleischhauer, formerly manager of the Washington-Oregon Corpn. of Vancouver for a franchise to supply electricity in Chehalis.

REPUBLIC, WASH.—Application has been made to the Commissioners of Ferry County by George S. Bailey of Republic, for a franchise to erect and maintain electric transmission lines over and along the public highways in Ferry County.

SEATTLE, WASH.—The Puget Sound Trac., Lt. & Pwr. Co. of Seattle, will at once expend about $30,000 in the construction of a system for improving the return of current to its various power stations, in order to avoid the possibility of damage to iron and steel pipes by electrolysis. A part of the new installation calls for the binding together of the rails of the two cable lines; along the electric lines, an additional cable will be constructed, and the current diverted from the rails and returned over the lines to the substation.

BURNS, ORE.—The City Council has passed a resolution authorizing the sale of $10,000 in bonds for the construction of an electric-light plant. H. C. Levins is Mayor.

SALEM, ORE.—The Wallowa Lake Amusement Co. of Salem, has applied to the state engineer Lewis for permission to utilize the water power of the Wallowa River to develop electricity for domestic and power purposes. A small plant, it is reported, will be erected at once at Joseph.

BURBANK, CAL.—Bids, it is understood, will soon be asked by the Board of Trustees for the construction of a municipal electric-light plant, to cost about $25,000.

CORONA, CAL.—A committee has been appointed by the Board of City Trustees to investigate the feasibility of establishing a municipal electric light plant in Corona.

HIGHLAND, CAL.—The Board of Supervisors has awarded the contract for lighting the streets of the city to the Southern California Edison Co., of Los Angeles, for a period of three years.

STOCKTON, CAL.—The Western States Gas & El. Co. of Stockton contemplates improvements to its properties during the coming year, as follows: Stockton division, $225,000; Richmond division, $20,000, and Eureka division, $12,000. Improvements increasing the output of the hydroelectric plant at Rock Creek on the American River one-third are being completed and additional transmission lines will be erected.

TULARE, CAL.—The Tulare County Co., of Tulare, has applied to the State Railroad Commission for permission to sell its electric plant and distributing system to the Mount Whitney Pwr. & El. Co., at $550,000.

VISALIA, CAL.—Contracts have been awarded by the Mount Whitney Pwr. & El. Co. of Visalia, for the construction of its fifth hydroelectric generating plant to be erected on the Kaweah River in the Sequoia National Forest. The new station will have an output of 10,000 hp., and will cost about $750,000.

ARCO, IDAHO.—Application has been made by Ralph Edmonds and B. Clarke of Idaho Falls for a seven-year franchise to construct and operate an electric-light and power plant and water-works system in Arco, the city to purchase the same at the expiration of franchise.

GOLIAD, UTAH.—The Westwood Heights Co. has closed a deal with the Goliad Supply Co. whereby the electric-light service and water mains will be extended into the Westwood Heights addition.

HOLBROOK, ARIZ.—Application has been made to the Board of Supervisors by T. M. Quebedeaux and K. H. Myers for a franchise to construct and operate an electric-lighting plant in Holbrook.

AMADOR, NEV. (Not a post office).—The Clearwater Gold & Copper Mining Co. is planning to issue bonds for the construction of a tramway and power plant at its mine near Amador. The work includes the installation of an air-compressor drill, construction of power plant to develop from 600 to 700 hp. and a tramway to cost about $100,000.

HAZEN, NEV.—The Nevada Valleys Pwr. Co., which owns power rights in the Truckee River Canyon, is contemplating extending its transmission lines at once to provide additional energy needed for a mill at Rochester, various mines and electric-lighting at Hazen and Lovelock. William H. Leffingwell is chief engineer.

Canada

THE PAS, MAN.—A by-law to authorize an issue of $50,000 in debentures to establish a municipal electric-light and power system will be submitted to the ratepayers.

HALIFAX, N. S.—The Nova Scotia Tramways & Pwr. Co. has petitioned the Provincial Board of Public Utilities for permission to take over the Halifax El. Tramways Co. and the Nova Scotia Lt. & Pwr. Co. It also asks for authority to increase its capital stock to $10,000,000 and to issue $5,000,000 in bonds. Of stock and bonds the board is asked to approve of the issue of $3,000,000 in bonds and 32,500 shares of preferred and 62,500 shares of common stock to the order of the Nova Scotia Lt. & Pwr. Co. These securities are to be used in part to develop the hydroelectric power sites of the Nova Scotia Lt. & Pwr. Co. on the Gaspereau River, which J. G. White & Co. estimate will cost $1,534,960.

HARRISTON, ONT.—A by-law authorizing a contract with the Ontario Hydro-Electric Power Commission will be submitted to the ratepayers on July 19.

LEAMINGTON, ONT.—The City Council is considering the question of establishing a municipal electric-light plant and distribution system.

TORONTO, ONT.—Estimates are being prepared by the Toronto Hydroelectric System of the capital cost to the city and the Hydroelectric system for the installation of a new street-lighting system on University Avenue, maintained by underground wires.

TORONTO, ONT.—Contracts, it is reported, have been awarded by the Ontario Hydro-Electric Power Commission for the construction of stations at Owen Sound, Chatsworth, Dutton, Thamesville, Ridgetown, Blenheim and Bothwell; authority has also been given to erect transmission lines to those stations.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JULY 6, 1915.

[Prepared by Mitchell & Allyn, 41 Park Row, New York.]

1,144,997. Semi-Automatic Exchange System; A. M. Bullard, New York, N. Y. App. filed Aug. 4, 1908. Central operator causes calling line to be automatically switched into connection with any line wanted. (Fifty claims.)

1,145,033. Attachment Plug; C. D. Platt, Bridgeport, Conn. App. filed Aug. 28, 1914. Two-part detachable swivel plug.

1,145,005. Electric Signal for Automobiles; H. C. Dolan, Detroit, Mich. App. filed May 2, 1914. Direction indicator.

1,145,006. Detachable Trolley-Harp; F. M. Du Bois, Thompsonville, Conn. App. filed Feb. 6, 1914. Clamp construction for holding harp to pole.

1,145,041. Switch for Electric Lighting System; T. Spencer, Philadelphia, Pa. App. filed Jan. 17, 1913. Lighting generator switched in circuit only when automobile is going from 10 miles to 25 miles per hour.

1,145,046. Ore-Concentrator; J. Weatherby, New Cumberland, Pa. App. filed Oct. 6, 1913. Shaking table, ore-grading construction.

1,145,057. Electrical Fitting; R. W. Davenport, Detroit, Mich. App. filed Nov. 25, 1912. Controlling switch and socket connector for heater.

1,145,066. Transmitting Apparatus for Wireless Telegraphy; A. H. Johnson, Washington, D. C. App. filed Nov. 14, 1912. Portable generating set operating on minimum power.

1,145,081. Dynamo Electric Machine; P. P. Politowski, Chicago, Ill. App. filed Apr. 24, 1914. Reduces counter magnetic effects of armature by distributing magnetic effect of field poles.

1,145,105. Case for Incandescent Electric Lamp Sockets; A. Weber, Sr., Schenectady, N. Y. App. filed Aug. 4, 1906. Bayonet lock construction for lamp-socket shells.

1,145,109. Telephone System; J. L. Wright, Cleveland, Ohio. App. filed March 7, 1911. Semi-automatic. (Eighty-nine claims.)

1,145,116. Alternating-Current Rectifier and Rectifying System; J. Chesler, East Orange, N. J. App. filed July 8, 1913. Vibrating contact construction.

1,145,120. Telephone-Exchange System; E. E. Clement, Washington, D. C. App. filed March 27, 1905. Centralizes labor of connecting subscribers.

1,145,124. Loom; S. B. Cutting, Bridgeport, Conn. App. filed Feb. 14, 1913. Stops motion.

1,145,152. Credit-Marking System; J. J. Leidigh, Milwaukee, Wis. App. filed July 2, 1906. Marking or punching apparatus combined with telephonic system for authorizing the extension of credit in stores.

1,145,213. Device for Incandescent Lamps with Metal Filaments; C. G. H. Remane, Berlin, Germany. App. filed March 30, 1910. Checks oscillations of the filaments.

1,145,224. Combined Automatic Burglar and Fire-Alarm System; O. Asmussen, Brooklyn, N. Y. App. filed March 13, 1913. Single circuit for both burglar and fire-alarm signals.

1,145,229. Telegraph System; W. M. Bruce, Jr., Springfield, Ohio. App. filed Nov. 7, 1913. Uses alternating-current energy.

1,145,235. Circuit Breaker; L. L. Elden, Dorchester, Mass. App. filed Oct. 11, 1904. Designed to carry large currents and operates easily.

1,145,239. System for Direct Energization of Radio-Telegraphic Antennae; E. Girardeau and J. Bethenod, Paris, France. App. filed June 17, 1913. High-frequency alternator energizes one antenna only under the condition that the charge is uniformly distributed in all phases.

1,145,245. Telephone-Exchange System; M. L. Johnson, Chicago, Ill. App. filed July 15, 1912. Lines extend to *A* and *B* boards. (Twenty-eight claims.)

1,145,253. Electric Bell; C. F. Mead and L. E. Richmond, Cleveland, Ohio. App. filed Aug. 15, 1913. Solenoid operates core carrying a striker.

1,145,287. Telephone-Telegraphic Communication System for Railroad Trains; F. Arens, New York, N. Y. App. filed Feb. 24, 1915. Continuous communication maintained by connection through conductor rails and brushes.

1,145,328. Electric Train-Lighting System; J. F. McElroy, Albany, N. Y. App. filed Dec. 15, 1905. Train lighting as distinguished from separate car lighting.

1,145,338. Spring-Jack; C. H. Vanderhoof, New York, N. Y. App. filed Dec. 6, 1913. For telegraph keys.

1,145,339. Electrical System of Distribution; E. Van Wagenen, New York, N. Y. App. filed Feb. 15, 1909. Storage-battery system in which average load which is taken by the generator is automatically regulated.

1,145,348. Synchronism Indicator; E. D. Carter, Montclair, N. J. App. filed Feb. 25, 1914. For flashing electric signs.

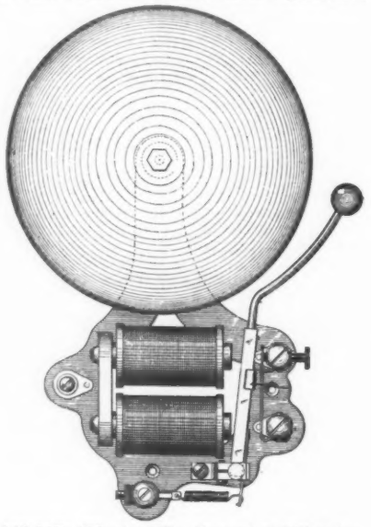
1,145,361. Separable-Husk-Socket Fitting; E. H. Freeman, Trenton, N. J. App. filed March 27, 1914. Quickly-detachable lamp-socket construction.

1,145,366. Conical Helix; C. D. Herrold, San Jose, Cal. App. filed June 2, 1913. Inductive coupling.

1,145,383. Electric Lamp Fixture; A. C. Williams, Chicago, Ill. App. filed April 20, 1912. Adjustable supporting stem construction.

1,145,393. Cooler for Telephone Instruments; W. P. Stunzm, Lansdowne, Md. App. filed July 25, 1912. Circulates cooling fluid around granular carbon.

1,145,424. Separable Connector for Electrical Conductors; C. J. Klein, Milwaukee, Wis. App. filed Jan. 13, 1913. Longitudinally separable, with means to prevent rotation or accidental separation.



1,145,507—Electrically Operated Vibrator

1,145,453. Circuit-Controlling Device; P. H. Zimmer, Milwaukee, Wis. App. filed March 10, 1913. For motors, etc.; has means for insuring definite-time intervals in operation.

1,145,460. Printing-Telegraph System and Alphabet; C. G. Ashley, Chicago, Ill. App. filed Nov. 12, 1910. Receiving characters directly readable by anyone.

1,145,468. Electric-Lighting System for Cars; J. L. Creveling, New York, N. Y. App. filed May 28, 1908. Resistor automatically inserted after batteries are charged.

1,145,490. Printing Telegraph Mechanism; O. L. Kleber, Pittsburgh, Pa. App. filed June 8, 1914. Controls rotation of the printing wheel.

1,145,507. Electrically Operated Vibrator; G. L. Patterson and I. F. Badeau, New York, N. Y. App. filed Sept. 8, 1911. For bells, etc.—contact broken substantially at completion of power stroke of the armature.

1,145,501. Single-Phase Motor; O. S. More and L. G. Long, Indianapolis, Ind. App. filed Apr. 1, 1912. Started as commutator motor.

1,145,509. Electrochemical Controlling Apparatus; W. J. Pike and R. J. Sutton, Grand Rapids, Mich. App. filed May 20, 1915. For impregnating a stream of fluid with a suitable substance.

1,145,542. Automatic Telephone Switching Apparatus; J. G. Blessing, Chicago, Ill. App. filed Oct. 11, 1910. Improved and highly efficient calling mechanism. (Sixty-four claims.)

1,145,544. Impulse Transmitting Device; J. C. Blessing, Chicago, Ill. App. filed July 31, 1913. For automatic telephone systems.

1,145,543. Impulse Transmitting Device; J. G. Blessing, Chicago, Ill. App. filed Aug. 2, 1913. Controlled by a plurality of keys. (Thirty-seven claims.)

1,145,551. Transformer; J. Burke, Erie, Pa. App. filed Dec. 10, 1910. Core construction with good magnetic contacts.

1,145,554. Sound Indicator; F. W. H. Clay, Pittsburgh, Pa. App. filed Oct. 25, 1907. Maintains diaphragm in a continued state of vibration.

1,145,565. Motor-Generator Set; C. W. Dake, Chicago, Ill. App. filed June 17, 1912. Housing construction.

1,145,569. Electric Switch; W. E. Date, Westfield, N. J. App. filed May 24, 1912. Overload type.

1,145,575. Dynamo Electric Generator; F. Eichert, Berlin, Germany. App. filed March 18, 1912. For bicycles, etc.—has short-circuiting device for armature coil.

1,145,586. Electric Attachment for Ophthalmoscopes; H. G. Herold, New York, N. Y. App. filed March 14, 1914. Multiple-lens type with special controller.

1,145,593. Electrolytic Cell and Method of Maintaining the Efficiency Thereof; W. M. Jewell, Chicago, Ill. App. filed March 2, 1914. Maintains flow of anode liquor from lower portion of anode chamber toward lower portion of cathode chamber.

1,145,594. Short-Circuiting Device for Electric Motors; C. L. Kennedy, South Braintree, Mass. App. filed Aug. 1, 1914. Centrifugal devices, cannot score the commutator.

1,145,612. Dynamo-Electric Machine and Means for Cooling Same; E. H. Porter, Philadelphia, Pa. App. filed Oct. 22, 1913. Circulates cooling medium through copper-tube winding.

1,145,632. Means for Controlling Telephone-Circuits; W. C. Ude, West Haven, Conn. App. filed May 3, 1913. For restoring telephone mechanisms to normal ringing position.

1,145,658. Wireless Telegraph Detector; W. E. Ashton and A. M. Curtis, New York, N. Y. App. filed April 27, 1907. Body of zincite.

1,145,659. Automatic Selecting Multi-Party Telephone System; O. Asmussen, Brooklyn, N. Y. App. filed March 21, 1913. Special provision for non-interference.

1,145,660. Machine for Mounting Incandescent-Lamp Filaments; G. F. Atwood, Newark, N. J. App. filed Jan. 31, 1910. For securing filaments to the leading-in wires.

1,145,680. System of Electric-Motor Control; F. D. Hallock, Pittsburgh, Pa. App. filed Aug. 12, 1912. Starting and accelerating.

1,145,707. Mounting for Incandescent-Lamp Filaments; C. F. Scott, Pittsburgh, Pa. App. filed Nov. 2, 1908. Flexible-spring supports for the filament carrier.

1,145,717. Electrical Receptacle; G. B. Thomas, Bridgeport, Conn. App. filed Dec. 21, 1914. Grips in socket prevent accidental unscrewing of lamp.

1,145,721. Dynamo-Electric Machine; M. Walker, Old Trafford, England. App. filed Dec. 24, 1909. Exciter for alternating-current generator.

1,145,735. Electric-Wave Detector; C. D. Ainsworth, Worcester, Mass. App. filed June 13, 1913. Electrode in rarefied container with radio-active material.

1,145,747. Process for the Manufacture of Aluminium Nitrid; P. Bunet, Whitney, N. C. App. filed May 9, 1913. Continuous electric furnace.

1,145,748. Electric Furnace; P. Bunet, Whitney, N. C. App. filed May 9, 1913. Constructed to effect the advance of the mixture.

1,145,763. Fire-Alarm; E. E. Fryberg, Duluth, Minn. App. filed March 16, 1914. Gives alarm through telephone system.

1,145,764. Electric-Switch Lock; E. M. Fuller, Grand Rapids, Mich. App. filed Jan. 3, 1914. For motor-driven vehicles.

1,145,751. Appliance for Telephones; J. L. Creveling, New York, N. Y. App. filed Sept. 24, 1908. Double head receiver attachable to ordinary telephone receiver.

1,145,835. Maximum-Demand Meter; C. I. Hall, Chicago, Ill. App. filed March 3, 1911. Clock-controlled mechanism for timing intervals during which indicator mechanism is operative.

1,145,839. Diaphragm Horn; M. R. Hutchinson, Summit, N. J. App. filed Oct. 26, 1909. Motor shaft at an angle to the diaphragm.

1,145,861. Telephony; W. W. Dean, Elyria, Ohio. App. filed Aug. 6, 1909. Desk set construction.

1,145,862. Apparatus for Electrolytic Purification of Liquids; J. L. Goucher, New York, N. Y. App. filed March 10, 1909. Liquid, such as milk, completes circuit between different containers.

13,942 (Reissue). Sanitary Mouthpiece; E. M. Jenkins, Italy, Texas. App. filed Jan. 14, 1914. Original No. 1,112,291 dated Sept. 29, 1914. Plurality of telephone-mouthpiece shells with disinfectant therebetween.